LEVEL II

Snohomish Estuary Wetlands Study

VOLUME III
CLASSIFICATION & MAPPING

~~VOLUME IV~~
~~DELINEATION OF WETLAND BOUNDARIES~~

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This study is intended to aid the Corps, other public agencies, and permit applicants in evaluating the biological impacts of proposed development activities in the Snohomish River basin. The most critical biological areas within the Snohomish River basin are marshes, swamps, and forested riparian areas. Some of the specific critical areas within the three critical habitat types are: salt marshes at the mouth of Quilceda Creek, the salt marsh on the eastern tip of Smith Island, and the salt marsh east of the Tulalip dump, large freshwater/brackish marshes southeast of Marysville, all

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freshwater marshes found around oxbow ponds, swamps and marshes on Otter Island, the four large swamps on Ebey Island including a large swamp on the southwestern corner owned by the Washington State Game Department, and large cottomwood dominated riparian strips along the Snohomish, Skykomish, and Snoqualmie Rivers.

VOLUME III

SNOHOMISH ESTUARY WETLANDS STUDY

Classification and Mapping

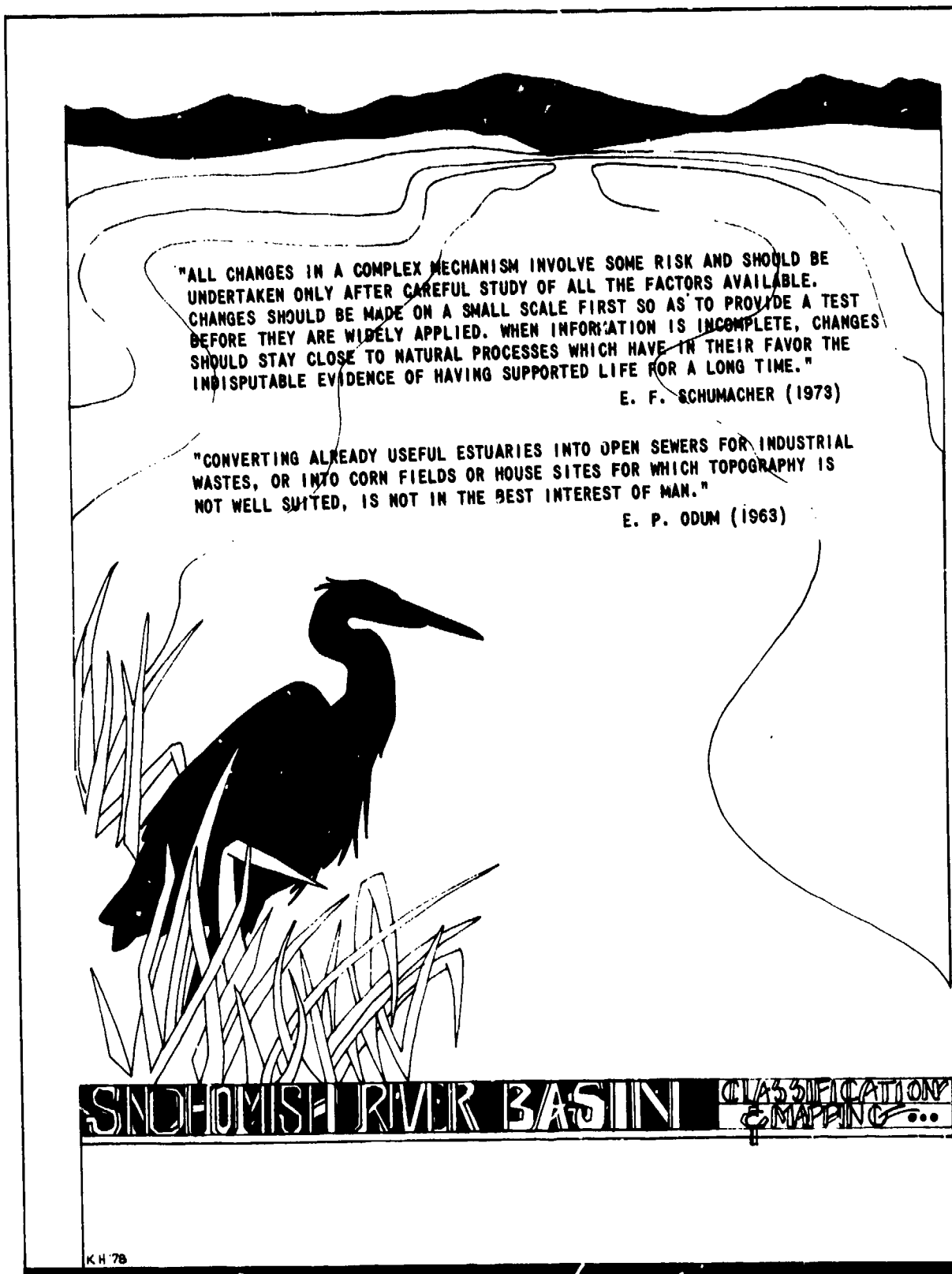
Prepared for

U.S. Army Corps of Engineers
in accordance with
Contract No. DACW67-77-C-0070

by

Galen Burrell
Washington State Department of Game

July 1978


"ALL CHANGES IN A COMPLEX MECHANISM INVOLVE SOME RISK AND SHOULD BE UNDERTAKEN ONLY AFTER CAREFUL STUDY OF ALL THE FACTORS AVAILABLE. CHANGES SHOULD BE MADE ON A SMALL SCALE FIRST SO AS TO PROVIDE A TEST BEFORE THEY ARE WIDELY APPLIED. WHEN INFORMATION IS INCOMPLETE, CHANGES SHOULD STAY CLOSE TO NATURAL PROCESSES WHICH HAVE IN THEIR FAVOR THE INDISPUTABLE EVIDENCE OF HAVING SUPPORTED LIFE FOR A LONG TIME."
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E. P. ODUM (1963)
WETLANDS
SNOHOMISH RIVER BASIN
CLASSIFICATION & MAPPING
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Introduction

1. A contract was issued by the U.S. Army Corps of Engineers to the Washington State Game Department to map the habitat types found in the Snohomish River basin (see Figure 1 for location of area mapped). Also, critical biological areas and habitat types were identified. Despite the extensively altered or developed nature of the Snohomish River basin, it is necessary to identify its essential features in order to effectively respond to present and future demands in a more environmentally sound manner. The contract issued to the Game Department to classify the habitat types on the Snohomish River and its tributaries is an attempt to identify these features, to assist in consideration of land-use management.

Methods

2. During the initial stage of this study, a classification system (Appendix A) was developed for use in the entire Snohomish River basin. The majority of the system is the same as that presently being used by the Coastal Habitat Inventory Team, Washington State Game Department. However, some changes were made in the aquatic lands section of the classification system. These changes follow descriptions of Eilers (1975), Jefferson (1975), Anderson, et. al. (1976), Cowardin, et. al. (1977), and the author's descriptions and names when different habitat types were found. An example of the latter is the intertidal brackish/freshwater swamps.

3. To identify different habitat types found in the river basin, the following methods were used: (1) all areas on color infrared and black and white aerial photographs which appeared to be distinct vegetative or

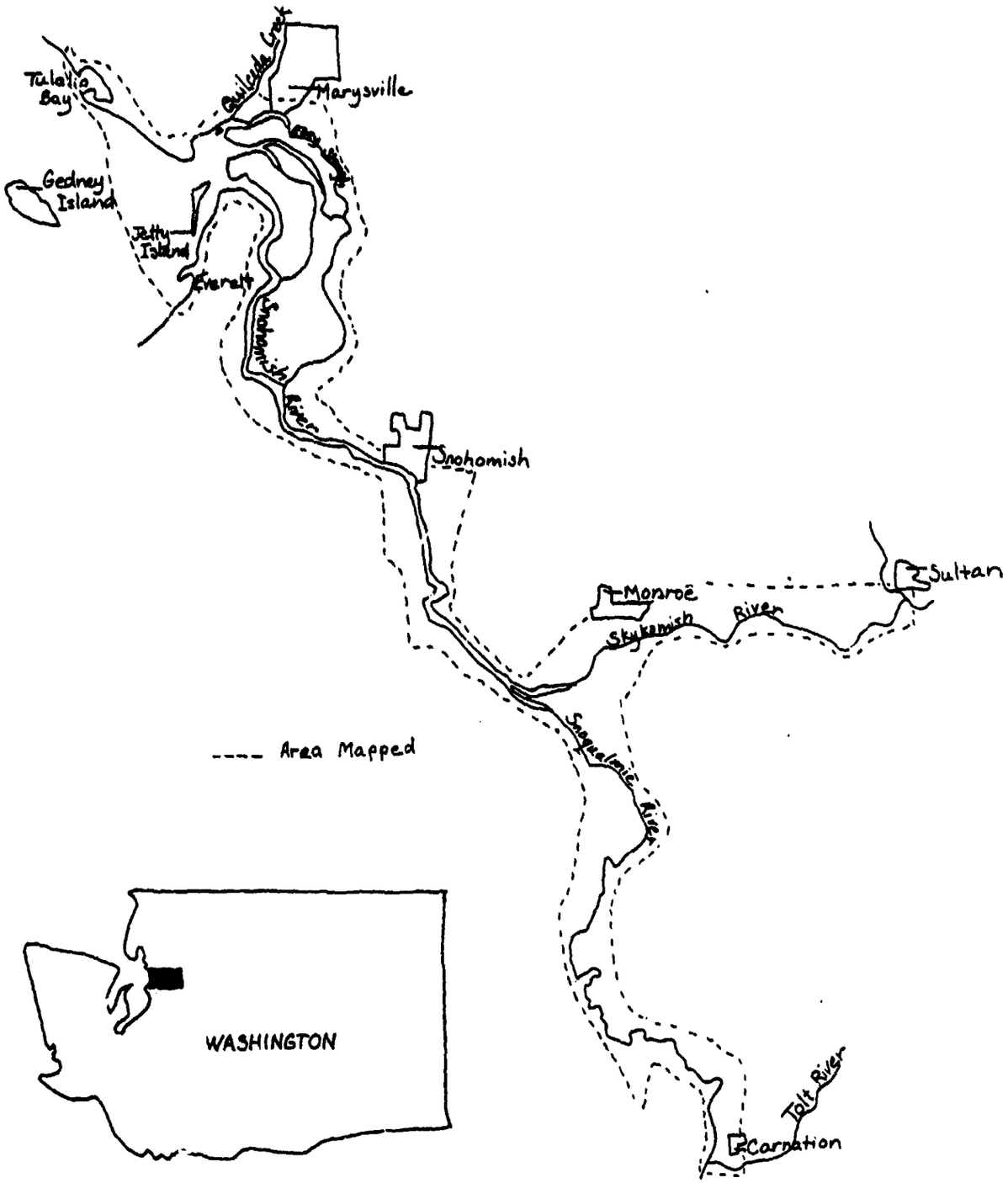

Figure 1. Map of the Snohomish River basin, study area.

habitat types were noted; (2) these were then groundtruthed to confirm or correct the type designations; and (3) line transects were placed through some salt marsh communities to better define fourth level types (see paragraph 10 for a definition of fourth level types).

4. Vegetative analysis in the salt marsh community was done by the line-intercept technique as described by Cox (1972). Ten-meter transects were used. Four line transects were placed in the Juncus-Potentilla-Agrostis-Triglochin-Deschampsia community, three in the Carex-Triglochin community and two in the Carex-Potentilla-Agrostis-Triglochin-Deschampsia community.

5. Color infrared aerial photographs (1:6000) were used to map the area downstream from the confluence of Ebey Slough, while black and white aerial photographs (1:12000) were used to map the area upstream from the confluence of Ebey Slough. Stereo pairs of these aerial photographs were placed under a mirror stereoscope. A sheet of mylar was placed over one of the stereo pairs. Polygons were then traced around each habitat type, greater than or equal to one-half acre in size, found in the photograph.

6. To determine the accuracy of this process, using the color infrared aerial photographs, 75 polygons were randomly chosen for field checking. Mapping accuracy was greater than 95 percent. No attempt was made to determine mapping accuracy on the black and white photographs, since each polygon was checked in the field.

7. After photo-interpreting and field checking were completed, polygons from all photographs were transferred to a mylar overlay placed on either a 1:6000 or 1:12000 base map of the study area.

8. Habitat types were photographed and 35mm color slides have been submitted with this report.

9. Included with this report are 7 maps (Figure 2) showing habitat types of the Snohomish delta and estuary. Maps showing habitat types in areas upstream of the confluence of Ebey Slough and the Snohomish River are available for review at Seattle District, U.S. Army Corps of Engineers.

Results

10. The system which was used for classifying the Snohomish River basin is presented in Appendix A. This classification system has four levels, where a one-digit identifier is more general than a four-digit identifier. For example, number 6 refers only to aquatic lands; 62 specifies vegetated nonforested wetlands; 624 is salt marsh; and 624[illegible] refers to a specific salt marsh plant community, Carex. Also, a zero identifier is used in the fourth level to cover all other possibilities not listed at that level.

11. Narratives for the classification system are given in Appendix B. This section includes a description of each habitat type and a general discussion on the relative biological importance of habitat classes.

12. Some problems were encountered during the mapping process. These were: (1) color infrared signatures for habitat types varied between photographs and (2) eelgrass boundaries were difficult to determine from the aerial photographs. More time was needed for ground checking than had been expected due to the variability of color signatures between infrared photographs. Availability of both false color infrared and true color or black and white photographs would alleviate this problem.

13. Eelgrass beds sometimes occur in depths which make them nearly indiscernable on aerial photographs unless special photographic techniques are used. For this reason, determining the exact boundaries of the eelgrass beds may require observation by diving.

14. Appendix C lists area totals (in acres and hectares) of all habitat

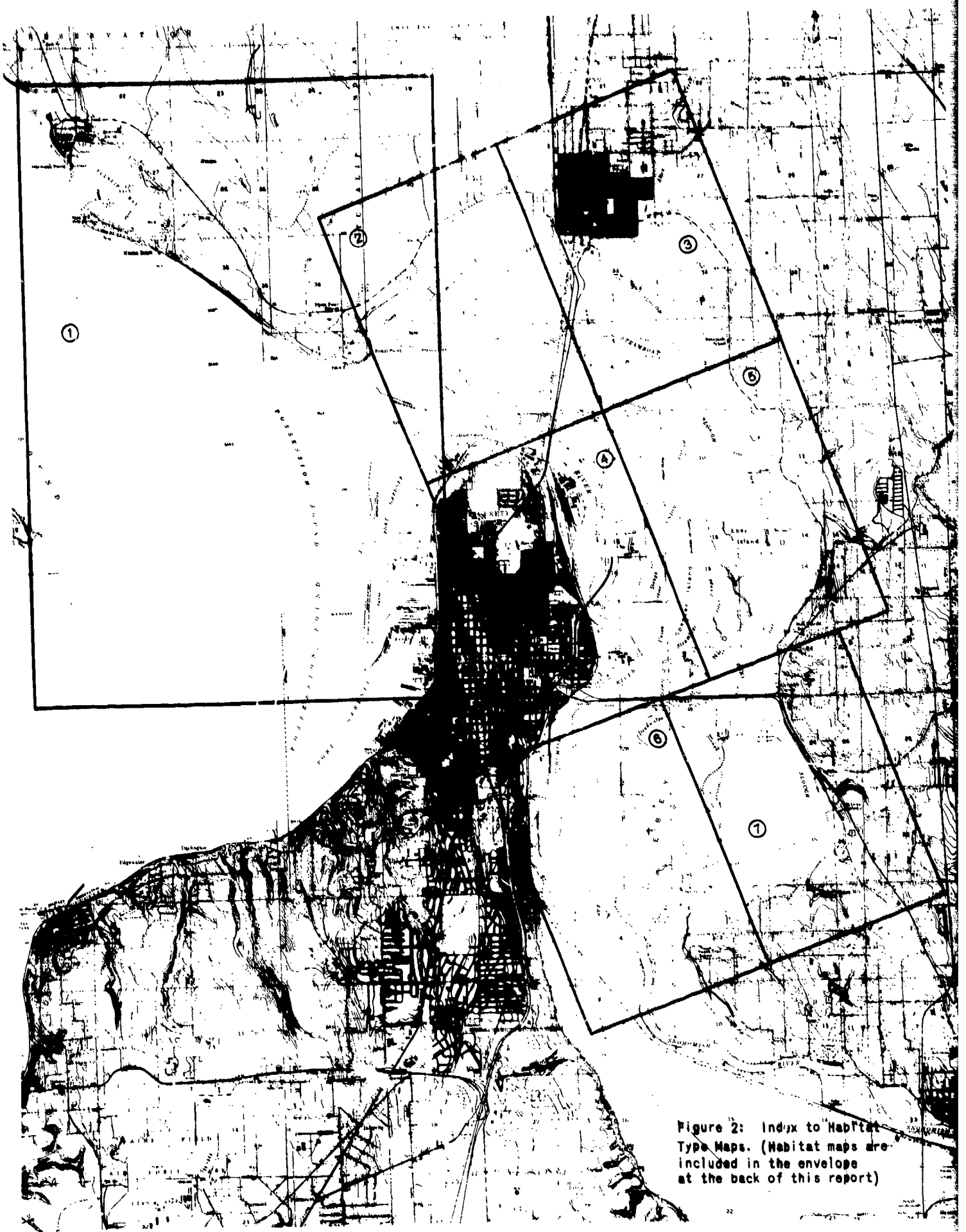

Figure 2: Index to Habitat Type Maps. (Habitat maps are included in the envelope at the back of this report)

classes found on the maps.

Discussion

15. This study is intended to aid the Corps, other public agencies, and permit applicants in evaluating the biological impacts of proposed development activities in the Snohomish River basin. The most critical biological areas within the Snohomish River basin are marshes, swamps, and forested riparian areas. Some of the specific critical areas within the three critical habitat types are: salt marshes at the mouth of Quilceda Creek, the salt marsh on the eastern tip of Smith Island, and the salt marsh east of the Tulalip dump, large freshwater/brackish marshes southeast of Marysville, all freshwater marshes found around oxbow ponds, swamps and marshes on Otter Island, the four large swamps on Ebey Island including a large swamp on the southwestern corner owned by the Washington State Game Department, and large cottonwood dominated riparian strips along the Snohomish, Skykomish, and Snoqualmie Rivers.

16. Reasons for the critical biological area designation given to marshes, swamps and forested riparian habitat types are their high productivity, the large number of wildlife and plant species almost exclusively dependent on these types; the dependence of wildlife from other habitat types on these types; their relative scarcity; and their role, particularly marshes and swamps, in flood control and maintenance of water quality.

17. Marshes and swamps are some of the most productive habitat types known to man (Whittaker 1975). Because of their high productivity, they are inhabited by a diverse array of plants and animals and therefore, support complex food chains. The loss of these habitats can result in the loss of many animals and plants directly associated with marshes and swamps and can cause the decline of wildlife populations in adjacent habitats.

18. Riparian type habitats are streamside or riverside communities (Pase and Layser, 1977), whose influence is felt far beyond the river's banks. Because of the combination of elements that make up riparian systems, they can support a high diversity of plant and animal life. Plant assemblages are often only associated with this habitat type and the aggregation of animals and plants are biologically important (Hubbard 1977). Riparian systems are critical to the survival of native fishes, and are of paramount importance to many birds' breeding activities. Other birds which are not so restricted, show a definite preference for the riparian zone. In fact, the riparian ecosystems in the southwest supports the highest density of nesting bird species in the United States (Johnson et. al. 1977). Most mammals are not as dependent, yet the plant communities associated with rivers and their bottomlands offer a rich diversity of forage and cover, resulting in high diversity of animal inhabitants.

19. The classification and mapping of the Snohomish River basin is a beginning step in developing an understanding of the complex biological interrelationships of this riverine and estuarine system. If a more complete understanding of these complex biological relationships is desired, more ecological research should be done in this area. Perhaps, more information may show that some habitats are even more, or less, critical than had been thought which could have an effect on land use decisions made in the Snohomish River basin. The next step in the study of the Snohomish River basin would be an inventory of what plants and animals are there.

20. I would like to thank Karen Helmerson, Alice Stickney, Jennie Wood, Rick Knight, Bill Nelson, Ron Van bianchi, Ron Hirschi, Tom Juelson, and Rick Albright for assistance during this study.

Appendix A

Habitat Classification System for the Snohomish River Estuary Study

Level 1	Level 2	Level 3	Level 4
1 Urban	11 Residential	*111 Nonwooded Residential	
		*112 High Density Residential	
		*113 Wooded Residential	
	*12 Commercial/ Service/ Industrial		
	14 Transportation/ Utility	141 Airport	
		142 Ferry Service	
		*143 Highway	
		*144 Railroad	
		*145 Pipeline	
		*146 Bridge	
		147 Power Line/ Right-of-way	
		148 Water and Waste Treatment/ Storage	*1480 Other
			*1481 Water Supply
			*1482 Sewage Treatment
	*15 Harbor/Port	*152 Marina	
		153 Log Storage	*1531 Log Yard
			*1532 Log Raft
		*154 Riprap	
		*155 Dike	
		*156 Breakwater	
		*157 Piling	
		*158 Pier	
	16 Construction		
	*17 Extractive		
	18 Open Land	*181 Scraped Area	
		*182 Dredge/Fill	
		*183 Refuse Station	
	19 Recreation	*191 Park	
		*192 Golf Course	
		*193 Urban Wooded	

*Those habitat types found in the study area.

Level 1	Level 2	Level 3	Level 4
2 Agriculture	*21 Crop/Pasture		
	22 Orchard/ Vineyard/ Nursery	221 Orchard 222 Vineyard 223 Nursery	
	23 Mariculture		
	*24 Inactive Agriculture		
	*25 Farm Yard		
3 Nonforested, Vegetated Uplands	31 Grassland	*311 Meadow *312 Beach Grassland *313 Open Grassland	
	32 Shrub	320 Other *321 Successional Shrub	
	33 Riparian	*331 Shrub *332 Grass *333 Shrub--Grass	
	34 Bluff		
4 Forested Uplands	41 Coniferous Forest	411 Regeneration (to 14 years)	
		412 Pole Stage (closed canopy)	*4120 Other 4121 Pole Stage/ Successional Shrub
		413 Second Growth (open canopy)	4130 Other 4131 Douglas Fir-Madrone, Second Growth
		414 Old Growth (approx. 150 years)	*4140 Other 4141 Douglas Fir-Madrone, Old Growth
		415 Christmas Trees	
	42 Broadleaf Forest	421 Regeneration Broadleaf	*4210 Other *4211 Regeneration Broadleaf/ Successional Shrub
		422 Immature Broadleaf	*4220 Other *4221 Immature Broadleaf/ Successional Shrub
		423 Mature Broadleaf	*4230 Other *4231 Mature Broadleaf/ Successional Shrub

Level 1	Level 2	Level 3	Level 4
	43 Mixed Forest	*431 Regeneration Mixed	
		432 Immature Mixed	
		*433 Mature Broadleaf/ Old Growth Conifer	
		*434 Second Growth Mixed	
	44 Open Woodland		
	45 Disturbed Forest	451 Clearcut Forest	
		452 Grazed Forest	
	46 Forested Riparian	461 Coniferous	4611 Regeneration
			*4612 Pole Stage
			*4613 Second Growth
			4614 Old Growth
		462 Broadleaf	*4621 Regeneration
			*4622 Immature
			*4623 Mature
		463 Mixed Forest	4631 Regeneration
			4632 Immature
			4633 Second Growth
			4634 Mature
	47 Forested Bluff	471 Coniferous	
		472 Broadleaf	
		473 Mixed	
5 Water	51 River/Stream	*511 Estuarine Zone	
		512 Pastoral Zone	
		513 Floodway Zone	
		514 Boulder Zone	
		515 Intermittent Stream Zone	
	52 Lake/Pond	521 Lake	
		*522 Inland Pond	
		523 Coastal Pond	
		524 Beaver Pond	
		525 Farm Pond	
		*526 Fish Rearing Facility	
	53 Reservoir		
	*54 Bay/Estuary		
	55 Impoundment		

Level 1	Level 2	Level 3	Level 4
	56 Lagoon	561 Enclosed Lagoon	
		562 Open Lagoon	
	57 Blind Channel	*571 Freshwater Blind Channel	
		*572 Marine Blind Channel	
	58 Canal/Waterway		
	59 Open Water		
6 Aquatic Lands	61 Aquatic Land-Forested	611 Intertidal Freshwater/Brackish Swamp	*6111 With Picea *6112 Without Picea
		612 Freshwater Swamp	*6121 With Picea *6122 Without Picea
	*62 Aquatic Land-Vegetated Nonforested	621 Nereocystis Communities	
		*622 Other Algal Assoc.	*6221 Ulvoid 6222 Laminarian 6223 Fucoid
		*623 Eelgrass (Zostera spp.)	
		624 Salt Marsh	*6240 Other *6241 Carex *5242 Triglochin-Carex *5243 Carex-Potentilla-Agrostis-Triglochin-Deschampsia *6244 Juncus-Potentilla-Agrostis-Triglochin-Deschampsia *6245 Disturbed Carex *6246 Scirpus *6247 Salicornia
		625 Brackish/Freshwater Intertidal Marsh	*6250 Other 6251 Scirpus *6252 Scirpus-Typha *6253 Typha *6254 Carex
		626 Freshwater Marsh	*6260 Other *6261 Scirpus *6262 Typha 6263 Scirpus-Typha

Level 1	Level 2	Level 3	Level 4
			*6264 Juncus depression/ pasture
			*6265 Carex
	*63 Aquatic Land-Nonvegetated	631 Rock	
		632 Cobble	
		633 Mixed Coarse	
		634 Mixed Medium	
		635 Mixed Fine	
		*636 Sand	
		*637 Sand-Silt	
		*638 Silt/Clay or Mud	
7 Other Lands	71 Spit	*711 Vegetated Spit	
		712 Nonvegetated Spit	
	*GB Gravel Bar		
	*SB Sand Bar		

Appendix B

HABITAT DESCRIPTIONS FOR THE SNOHOMISH RIVER BASIN STUDY

1 Urban

This class is the general classification for developed areas and includes residential, industrial, transportation and recreational areas, either existing or under construction. It has been used for all urban areas except those with value as wildlife habitats; in such cases a two, three, or four digit identifier will be used but in all of these the first digit will be 1.

*11 Residential

The residential class includes those areas containing dwellings for human habitation and adjacent lands obviously associated with such dwellings, ie: yards, gardens, small pastures and outbuildings.

Residential areas afford a limited amount of habitat to a few wildlife species; for example, House Finches, House Sparrows, Robins, and a few small raptors. As one might expect, suburban (low density housing) areas contain more wildlife habitat, both in extent and diversity, than urban (high density housing) areas. As a result, numbers of wildlife species also increase. Residential areas in river basins have overall negative impacts on wildlife due to loss of habitat.

*111 Nonwooded Residential

Areas with low density housing (less than two dwellings per acre), usually outside incorporated communities. Natural cover is mostly replaced with horticultural plantings.

*112 High Density Residential

Areas with high density housing including single and multi-family units as well as neighborhood services.

*113 Wooded Residential

Well wooded areas with low density housing (less than two dwellings per acre). The natural cover is minimally altered.

*12 Commercial/Service/Industrial

The commercial class includes areas developed for commercial or public service purposes, while the industrial class includes areas used for industrial purposes. Such areas are usually, but not always, heavily impacted by human structures and activities.

The value of these areas to wildlife is extremely limited. In most

*Those habitat types found in the study area.

cases, development has been responsible for a decrease, or elimination of the wildlife that formerly used such habitats. Also, industrial wastes discharged into the Snohomish River, Ebey Slough, Steamboat Slough, and Union Slough, are detrimental to wildlife. For example, Conley (1977) found that juvenile salmon were more abundant in Ebey Slough than in the Snohomish River. He related this difference to more industrial wastes being discharged into the Snohomish River.

14 Transportation/Utility

Areas used for transportation and utility purposes which have an important impact on wildlife or wildlife habitat and are of sufficient size to be mapped.

Most types of transportation facilities impact wildlife. Two types of direct impacts are: (1) loss of wildlife habitat from their construction, and (2) animals killed attempting to cross highways or railroads.

Some water treatment and storage facilities of the river basin are important areas for a number of wildlife species. An example is the Everett sewage ponds east of I-5, where large numbers of waterfowl, gulls, grebes and other water birds feed and rest. This area is also used by an associated number of raptors which prey on these birds. Muskrats also use the area. Animals in this area most likely inhabit other parts of the river basin.

Paper and pulp mill effluent treatment ponds on Smith Island have little if any biological value to animals using the estuary.

*141 Airport

Areas used for aircraft takeoff and landings. Usually includes substantial expanses of open grassland.

*142 Ferry Service

Ferry landing facilities. Usually includes substantial amounts of piling.

*143 Highway

Major thoroughfares with associated median strips or cleared roadside areas.

*144 Railroad

Railroad rights of way and associated disturbed areas.

*145 Pipeline

An underground oil pipeline is found on Ebey Island.

*146 Bridge

Major Bridges.

*147 Power Line/Right of Way

Power lines and their associated rights of way.

*148 Water and Waste Treatment/Storage

Ponds used for the treatment of sewage effluent and ponds used to hold potable water. Two types of sewage treatment facilities are those of the city of Everett (just east of I-5) and those on Smith Island used to treat effluent from pulp and paper mills.

*1480 Other

Any water and waste treatment/storage facility not identified in the following two categories.

*1481 Water Supply

Ponds used for potable water storage.

*1482 Sewage Treatment

Ponds used for the treatment of sewage and mill effluent.

15 Harbor/Port

Facilities located along the shoreline and/or extending beyond the shoreline which are used for servicing commercial and recreational watercraft and for related commercial activities. This category includes those construction features necessary for protected moorage.

These areas have limited wildlife value. In most cases, their construction eliminates wildlife habitat. For example, intertidal log rafts were found by Smith (1977) to decrease abundance of all common invertebrates of tidal marsh-mudflat fauna of the Snohomish River delta. This decrease in invertebrate numbers affects the entire food chain of the estuary. One positive aspect of log rafting is that they are used by birds and harbor seals as resting sites.

Dikes, or more specifically, their vegetation, appear to have value to wildlife. Dikes form a thin band which threads its way through much of the estuary resulting in greater habitat diversity. However, dikes also alter and/or destroy the wetlands they enclose.

Breakwaters, pilings, and piers create resting areas for gulls and Great Blue Herons, habitat for sessile marine organisms requiring hard substrates, and shelter for fishes. They may also affect longshore drift which alter shoreline habitats.

Riprapping can have a negative impact on the biology of a stream or river. For example, extensive removal of vegetation which shades the stream will result in an increase in water temperature and loss of cover, which will be detrimental to salmonid fishes. Also, channel alteration (riprapping) can affect insect production; the food supply for fish. The most obvious impact is the loss of riparian vegetation and its associated wildlife (See Table B-1 for a list of animals occurring in the riparian habitat type, during the spring of 1978 in the Snohomish River basin).

*152 Marina

Moorage areas for public or private use generally consisting of multiple piers or docks and related service facilities.

*153 Log Storage

Areas used for the storage of logs before processing or selling.

*1530 Other

Types of log storage facilities not found in the following two categories.

*1531 Log Yard

Areas on land used for log storage.

*1532 Log Raft

Areas on water or mudflats where logs are stored.

*154 Riprap

Large boulders or other material used to protect uplands from erosion.

*155 Dike

Structures used to control water flow for the purpose of flood or erosion prevention or for maintenance of a navigable waterway. Common plant species found growing on the dikes of the Snohomish River basin are: red alder (Alnus rubra), spirea (Spirea Douglasii), bulrush (Scirpus spp.), foxglove (Digitalis purpurea), velvet-grass (Holcus lanatus), cattail (Typha latifolia), Himalayan blackberry (Rubus discolor), evergreen blackberry (Rubus laciniatus), and salmonberry (Rubus spectabilis).

*156 Breakwater

Protective devices, usually built offshore, and used to prevent beach, bluff or shore erosion as well as for protection of navigational areas from adverse wave conditions.

*157 Piling

Vertical members driven into the bed of marine waters for support of pier decking. Also applies to areas of deteriorated structures where only the piling remains.

*158 Pier

Structures used for providing access to wet berthing areas; usually in connection with offloading of commercial vessels. Most piers are supported by wood or metal pilings.

*16 Construction

Areas undergoing a change in land-use due to the development of some type of structure.

*17 Extractive

Areas used for mining; esp. sand and gravel extraction.

These areas have little wildlife value. The removal of substrate is usually destructive to the flora and fauna inhabiting that area.

*18 Open Land

Areas which have been stripped of vegetative cover due to activities of man.

By stripping vegetative cover from these lands, wildlife habitat is virtually destroyed and wildlife populations using it are either lost or reduced in numbers. Generally, creation of this type has a more detrimental effect on wildlife than classes above because larger areas are often involved. A good example of this type is the Tulalip Dump where a highly productive salt marsh and intertidal swamp was destroyed along with the animals that occupied the area.

*181 Scraped Area

Areas cleared of vegetation primarily for the development of crop or pasture land.

*182 Dredge/Fill

Areas with little or no vegetation where dredged material has been dumped.

*183 Refuse Station

Areas where garbage is dumped. In the case of the refuse station west of Highway 99 on Ebey Island (Tulalip Dump), garbage is dumped and covered by soil. These areas contain little or no vegetation.

19 Recreation

This category includes parks, camps, golf courses, or small woodlots within well developed residential areas.
Recreational areas (e.g. golf courses, parks, and urban wooded areas) afford some value as nesting and feeding areas for a number of bird species. However, their relative value to wildlife still needs to be determined.

*191 Park

Areas developed for urban recreational usage and usually containing play fields, grassy areas, and internal road systems as well as trees and shrub plantings and areas of relatively undisturbed vegetative cover.

*192 Golf Course

An area developed for playing golf and usually consisting of expansive areas of short grass interspersed with trees and shrubs.

*193 Urban W ooded

Small areas of undeveloped wooded land within well developed residential areas.

2 Agriculture

This class includes those areas being used, or having been recently used, for the production of crops. It does not include forest crops.

*21 Crop/Pasture

Areas of cultivated, mowed, or grazed land usually occurring on flat to gently rolling slopes with good moisture regimes. Agricultural usage may change on an annual basis due to crop rotation. Many of these areas were initially created by eliminating marshes. Loss of these diverse marsh communities for monotypic crop and pasture lands undoubtedly resulted in a reduction of many wildlife species. Presently crop and pasture lands of the Snohomish River basin are used as feeding areas for wildlife who also use other habitat types found within the river basin. Some of the animals using these areas are coyotes, mice, raptors, small birds, and waterfowl. (See also Table B-1 for a list of animals seen in this type during the spring of 1978 in the Snohomish River basin).

22 Orchard/Vineyard/Nursery

Those lands supporting trees, shrubs or vines used for agricultural or horticultural purposes.

Practically none of these areas are found in the Snohomish estuary.

*221 Orchard

Those lands supporting fruit or nut trees, e.g., apples, cherries.

*222 Vineyard

Those lands used for the production of grapes.

*223 Nursery

Those lands used for the production of trees or shrubs for ornamental plantings or replanting of forest lands.

23 Mariculture

This category includes those areas used for intensive culture of marine plants or animals. In Washington the most common types of mariculture are salmon, clam and oyster culture. Future maricultural efforts will likely be focused on algal and mussel production.

Areas used for mariculture are not found in the study area.

24 Inactive Agriculture

This category includes agricultural fields left for a period of time and undergoing a process of invasion by a variety of plant species such as annual grasses and forbs, and weedy species. These areas often occur as strips along agricultural fields.

These agricultural areas are of more value to wildlife than areas which are cultivated or grazed each year, because there is greater vegetative diversity and more cover in inactive than in active agricultural areas. These areas are used by such wildlife species as Red-tailed Hawks, Marsh Hawks, owls, Kestrels, California Quail, Ring-necked Pheasants, coyotes, and long-tailed weasels.

Table B-1. A list of animals, by habitat type, seen in the Snohomish River basin during the spring of 1978.

Habitat Type	Animal
21 Crop/Pasture	Band-tailed Pigeon
	Barn Swallow
	Black-capped Chickadee
	Brewer's Blackbird
	Gadwall
	Killdeer
	Mallard
	Marsh Hawk
	Meadowlark
	Red-tailed Hawk
	Ring-necked Pheasant
	Robin
	Savannah Sparrow
	Tree Swallow
	White-crowned Sparrow
33 Nonforested Riparian	Crow
	Fox Sparrow
	Rufous-sided Towhee
46 Forested Riparian	American Goldfinch
	Band-tailed Pigeon
	Bank Swallow
	Barn Swallow
	Bewick's Wren
	Black-capped Chickadee
	Black-headed Grosbeak
	Black-tailed Deer
	Bushtit
	Cowbird
	Flicker
	Great Blue Heron
	Green Heron
	Kingfisher
	Mourning Dove
	Northern Oriole
	Purple Finch
	Red-winged Blackbird
	Robin
	Rufous-sided Hummingbird
	Song Sparrow
	Tree Swallow
	Yellow-crowned Sparrow
	Yellow-rumped Warbler
	Yellow Warbler

Table B-1 continued.

Habitat Type	Animal
51 River/Stream	Common Merganser Great Blue Heron Killdeer Mallard Muskrat Spotted Sandpiper Wood Duck
522 Inland Pond	Blue-winged Teal Cinnamon Teal Great Blue Heron Kingfisher Mallard

*25 Farm Yard

This category includes farm buildings (i.e., barn, house, etc.), corrals and gardens.

Farm yards are important wildlife areas in that they are used for feeding and nesting by a small number of species. An example of animals which uses this type are Barn Swallows and Barn Owls which nest in barns.

3 Nonforested, Vegetated Uplands

Areas covered by grass or shrubs which may include bluffs and riparian vegetation not contiguous with forested areas.

31 Grassland

All open, ungrazed upland areas with grasses as their dominant vegetation. Woody species are not present. This vegetative type occurs on a variety of substrates and under many environmental regimes.

Beach grassland was the dominant type of grassland found in the study area, however, it occurred only on Jetty Island. This is an important, man-created wildlife habitat type on Jetty Island. Peters et al (1978) found this vegetative type on Jetty Island to be important nesting cover for Mallards, Spotted Sandpipers, and Glaucous-winged Gulls. Also, large numbers of Townsend meadow mice live in this community. Their remains were found in Short-eared Owl pellets and undoubtedly, these rodents also fall prey to other raptors of the Snohomish estuary.

*311 Meadow

Open areas which may contain surface water during late fall, winter and early spring. The vegetative cover is predominately grasses and sedges, although an abundance of other flowering annuals and perennials are characteristic.

*312 Beach Grassland

Strands of beach or dune grasses closely associated with sandy or cobbled substrates; partially protected from high winds, salt spray, and sand blasting by drift log barriers. Beach grassland was found only on Jetty Island where dominant plant species are dunegrass (Elymus mollis) and beach peavine (Lathyrus japonicus). Other plant species found in this habitat class on Jetty Island are listed in Table B-2. These are considered to be uplands because they are rarely inundated.

*313 Open Grassland

An unusual shoreline vegetative type in the Pacific Northwest;

Table B-2 Plant species found in the beach grassland (312) community on Jetty Island, 27 September, 1977.

Scientific Name	Common Name
Achillea millefolium	Common Yarrow
Agoseris sp.	False-dandelion
Alnus rubra	Red Alder
Ambrosia chamissonis	Silver Bursage
Anaphalis margaritacea	Pearly-everlasting
Anthemis arvensis	Mayweed
Artemisia suksdorfii	Coastal Wormwood
Aster subspicatus	Douglas' Aster
Athyrium filix-femina	Lady-fern
Atriplex patula	Common Orache
Berberis aquifolium	Tall Oregongrape
Bromus tectorum	Cheatgrass
Cakile edentula	Searocket
Carex macrocephala	Bighead Sedge
Chenopodium sp.	Lamb's Quarter
Conyza canadensis	Conyza
Dianthus armeria	Grass Pink
Elymus mollis	Dunegrass
Epilobium angustifolium	Fireweed
Epilobium paniculatum	Autumn Fireweed
Epilobium sp.	Fireweed
Grindelia integrifolia	Gumweed
Holcus sp.	Velvetgrass

Table B-2 continued

Hypericum perforatum	Klamath Weed
Laythyrus japonicus	Sea Peavine
Lepidium virginicum	Tall Peppergrass
Lupinus arboreus	Tree Lupine
Lychins alba	White Campion
Melilotus alba	White Sweetclover
Oenothera strigosa	Common Evening-primrose
Plantago lanceolata	English Plantain
Poa annua	Annual Bluegrass
Polypodium scouleri	Polypody
Populus trichocarpa	Black Cottonwood
Pseudotsuga menziesii	Douglas Fir
Pyrus fusca	Western Crabapple
Rumex acetosella	Field Dock
Rumex crispus	Curled Dock
Salix sp.	Willow
Saponaria officinalis	Saponaria
Senecio sylvaticus	Wood Ragwort
Solanum dulcamara	Bittersweet
Solidago sp.	Goldenrod
Sonchus arvensis	Milkthistle
Sorbus sp.	Mountain-ash
Spergula arvensis	Spergula
Tanacetum vulgare	Common Tansy
Trifolium pratense	Red Clover
Vicia gigantea	Giant Vetch

occurring on rocky, exposed, south-facing promonotories, particular in San Juan County. A mixture of native and introduced grasses is characteristic of this land cover.

32 Shrub

Upland areas in which the dominant vegetation consists of woody perennials up to 20 feet in height. Shrub-dominated communities often represent a successional state in a regenerating forest.

Successional shrub was the only shrub type found in the Snohomish River basin. It is an important wildlife habitat type since it occurs in small patches throughout the river basin, creating greater habitat diversity. Wildlife use this habitat type as escape cover, nesting areas, and as a source of food, such as blackberry. Common birds seen in this type were Song Sparrows, Rufous-sided Towhees and Robins.

320 Other

Includes all types not fitting the successional shrub category.

*321 Successional Shrub

A disturbed area undergoing a series of changes in plant types as it matures toward its previous climax type of vegetation. This process is referred to as plant succession. Transitional communities dominated by shrubs during this succession are included in the category. Himalayan blackberry, evergreen blackberry, spirea, and scotch broom (Cytisus scoparius)are often present in this habitat type in the Snohomish river basin.

33 Riparian

Delineates those upland types which are adjacent to and directly influenced by streams or standing water. This class is primarily associated with drainage ditches in the Snohomish River basin, or along rivers where woody riparian vegetation has been removed.

Riparian habitats are important areas to wildlife of the Snohomish River basin. The close association of upland plants with water results in a highly diverse habitat type. Animals commonly using this type in the Snohomish River basin are beaver, muskrat, river otter, mink, coyote, raccoon, long-tailed weasel, opossum, skunk, black-tailed deer, Mallard, American Widgeon, Green-winged Teal, Song Sparrow, Sharp-shinned Hawk, and Red-tailed Hawk.

*331 Shrub

Areas of riparian habitat where shrubs are dominant. Common shrubs found along these riparian strips are evergreen blackberry, Himalayan blackberry, and spirea.

*332 Grass

Areas of riparian habitat where grasses, sedges, and rushes are dominant. Common grasses and grass-like plants found along this riparian type are canarygrass (Phalaris arundinacea), velvetgrass, (Holcus spp.) and Baltic rush (Juncus balticus).

*333 Shrub—Grass

Areas of riparian habitat where shrubs, grasses and grasslike plants co-dominate.

34 Bluff

Steep to moderate slopes of varying substrate are classified as bluff.

Bluffs are found adjacent to the study area. They appear to be important wildlife habitats but biological information on these areas is lacking.

4 Forested Uplands

All upland areas in which tree species form a complete or partial canopy or are dominant in a matrix of grass, shrub or exposed rock.

41 Coniferous Forest

Forested lands in which the canopy is composed of at least 70 percent coniferous species. This vegetative cover type is extremely diverse in the Pacific Northwest and contains a complexity of constituent plant communities. Species commonly encountered in the canopy of a coastal coniferous forest include Douglas Fir (Pseudotsuga menziesii), western hemlock (Tsuga heterophylla), western red cedar (Thuja plicata), and Sitka spruce. Depending on the age of the stand, there is usually a rather definitive sub-canopy, shrub layer, and ground cover associated with a coniferous forest. This is climax vegtation in the Pacific Northwest.

Coniferous forests are an important habitat type to wildlife. Its relative scarcity in the Snohomish River basin magnifies its value. It adds diversity to the system and without it some animals using the basin would not be there. Examples of species using this habitat type are Cooper's Hawk, Band-tailed Pigeon, Pygmy Owl, Pileated Woodpecker, Chestnut-backed Chickadee, Winter Wren, Golden-crowned Kinglet, Pine Siskin and Oregon Junco.

411 Regeneration (to 14 years)

A regenerating forest in very early stages; individual trees may be up to fourteen years of age. Introduced herbaceous species are often interspersed with the conifer saplings because of the open canopy.

412 A class following the regeneration stage and preceding the second growth stage; characterized by a closed canopy and slender, even-aged stands. The tree age and size may vary between sites.

*4120 Other

Pole stage not mixed with successional shrubs.

4121 Pole Stage/Successional Shrub

A mixture of pole stage conifers with successional shrub. a transitional phase.

413 Second Growth (open canopy)

An age class following the pole stage and preceding old growth; usually characterized by an open canopy, dense sub-canopy and under-story.

4130 Other

Second growth which is not Douglas Fir mixed with Madrone.

4131 Douglas Fir-Madrone, Second Growth

A nearly even mixture of these plant associations is found in some isolated upland habitats.

414 Old Growth (approx. 150 years)

An age class in which individual trees are approximately 150 years old or more; characterized by uneven-aged stands and high species diversity. In the Snohomish River basin there were 11.6 acres of this rare type composed entirely of Sitka spruce.

*4140 Other

Any old growth stand other than 4141.

4141 Douglas Fir-Madrone, Old Growth

This combination occasionally occurs on rock islands or steep, rocky bluffs.

415 Christmas Trees

Areas where young, bushy coniferous trees arranged in rows, are growing in fields up to several acres in size. Trees are generally less than 10 feet in height and are in even aged stands.

42 Broadleaf Forest

As the name implies, this forest type consists primarily of broadleaf

(deciduous) species (usually 70 percent or more of the canopy). Regenerating conifers in the sub-canopy are typical of the broadleaf forest. A diverse ground cover may be present. Broadleaf species typically occupy wetter sites than do conifers. Characteristic species of this vegetative type include alder, willow (Salix spp.), and maple (Acer spp.). These are important areas for wildlife of the Snohomish River basin. Broadleaf forests are used as nesting, feeding and perching areas for birds. Stiles (1973) found Ruffed Grouse, Downy Woodpeckers, Willow Flycatchers, Black-capped and Chestnut-backed Chickadees, Brown Creepers, Winter Wrens, Bewick's Wrens, Robins, Wilson's Warblers, Black-headed Grosbeaks and Song Sparrows to be common nesters in alder forests close to the Snohomish River basin. (For a complete list of nesting and observed bird species of alder forests see Stiles (1973). He also found that species diversity of nesting birds changes with forest succession.

Patches of alder and maple forest are found throughout the river basin. These patches add considerable diversity to the riverine system.

421 Regeneration Broadleaf

An age class consisting of deciduous tree species less than or equal to 15 feet in height.

*4210 Other

Regeneration broadleaf not containing successional shrubs.

*4211 Regeneration Broadleaf/Successional Shrub

A mixed cover frequently associated with a diversity of herbaceous annuals and perennials.

422 Immature Broadleaf

An age class consisting of deciduous tree species between 15 and 45 feet in height.

*4220 Other

*4221 Immature Broadleaf/Successional Shrub

A mixture of immature broadleaf and successional shrub, a transitional phase.

423 Mature Broadleaf

A forest age class greater than 45 feet in height with a well-developed sub-canopy and ground cover present.

*4230 Other

Mature broadleaf not containing successional shrub.

*4231 Mature Broadleaf/Successional Shrub

Areas in which mature broadleaf and successional shrub are present but neither dominates.

43 Mixed Forest

Areas in which both broadleaf and coniferous species are present but where neither makes up more than 50 percent of the canopy is referred to as mixed. Constituent species are those typical of both coniferous and broadleaf forests.

Mixed forest types are probably of greater value to more species of wildlife than either coniferous or broadleaf forests. Since broadleaf and conifers occur together, this increased habitat diversity is reflected by increased faunal diversity. Animals found in either coniferous or broadleaf forests probably occur in this forest type. Some common bird species found nesting in the mixed forest community are Western Flycatchers, Hairy Woodpeckers, Pileated Woodpeckers, Yellow-rumped Warblers, Solitary Vireos, and Western Wood Pewees.

*431 Regeneration Mixed

Age class comprised of trees less than 15 feet in height.

432 Immature Mixed

An age class comprised of individual trees 15 to 45 feet in height.

*433 Mature Broadleaf/Old Growth Conifer

An age class in which both vegetation types are present but neither dominates.

*434 Second Growth Mixed.

A canopy of second growth conifers and broadleaf species, usually with a dense sub-canopy, shrub layer, and ground cover.

44 Open Woodland

Areas which contain a variety of trees with scattered individual plants not forming a closed canopy. These areas usually support a diverse ground cover of grasses and other herbaceous plants. Open woodland types often occur on dry, exposed sites.

Open woodlands do not occur in the study area.

45 Disturbed Forest

Forested areas which have been severely altered or destroyed by natural events or human activities and have not had sufficient time to regenerate are considered disturbed. This classification excludes urban wooded areas and farm wood-lots.

Forests within the study area have either been grazed heavily or clear-cut. Grazing affects forested uplands by removing the shrub layer under

the forest canopy, thus, animals which are dependent on this shrub layer are also eliminated. Clearcutting upland forests along the Snohomish River basin is done to create crop/pasture land. For this reason, all animal and plant species dependent on upland forests habitat types are removed along with the trees.

451 Clearcut Forest

A forest where all the trees have been removed.

452 Grazed Forest

A forest which has been heavily grazed by domestic livestock.

46 Forested Riparian

Upland types which are adjacent to and directly influenced by streams or standing water. The vegetation is dominated by coniferous and broadleaf trees. Common tree species are black cottonwood (Populus trichocarpa), alder, willow, and western red cedar.

Riparian forest systems are complex and therefore are very sensitive to alteration and vulnerable to degradation. An example of this complexity was noted by Stevens, et al. (1977), who demonstrated that the population densities of birds in habitats adjacent to the riparian type are influenced by the presence of a riparian area. This could mean that when a riparian habitat is removed or severely manipulated, not only are the riparian species of the area adversely influenced, but wildlife productivity in the adjacent habitat is also depressed. (see Table B-1 for a listing of animals seen in riparian habitats, during the spring of 1978 in the Snohomish River basin.)

461 Coniferous /Cf. 41/

4611 Regeneration /Cf. 411/

*4612 Pole Stage /Cf. 412/

*4613 Second Growth /Cf. 413/

4614 Old Growth /Cf. 414/

462 Broadleaf / Cf. 42/

*4621 Regeneration /Cf. 421/

*4622 Immature /Cf. 422/

*4623 Mature /Cf. 423/

463 Mixed Forest /Cf. 43/

4631 Regeneration /Cf. 431/

4632 Immature /Cf. 432/

4633 Second Growth /Cf. 433/

4634 Mature /Cf. 434/

47 Forested Bluff /Cf. 34/

471 Coniferous /Cf. 34 and 41/

472 Broadleaf /Cf. 34 and 42/

473 Mixed /Cf. 34 and 43/

5 Water

Both marine and freshwater habitats are considered in those classifications in which water is the principal medium.

51 River/Stream

Running water habitats are distinguished by a definite current which varies greatly with valley shape and other geo-hydraulic features in different streams and in different segments of the same stream course. Wolf Bauer's geo-hydraulic river zone classification system has been followed to characterize stream segments. All streams distinguishable on aerial photographs are included. No separation of stream types has been attempted based on average or annual stream flow, except for seasonally active streams. Scale constraints often prohibit accurate depiction of stream course borders; therefore, running water habitats are not always separated from associated riparian habitat. When this occurs the running water may be identified separately.

Rivers and streams are the backbone of the Snohomish River basin system. They allow the movement of nutrients into the estuary from farther upstream, without which, the productivity of the system would drastically decrease. It is critical habitat for benthic invertebrates, anadromous fishes, Ospreys, Great Blue Herons, Double-crested Cormorants, Belted Kingfishers, waterfowl, grebes, swallows, gulls, river otters, mink, beaver, muskrats, raccoons and harbor seals. Decline in water quality and alteration to rivers and streams will result in decreased productivity and numbers of animal species.

*511 Estuarine Zone

Strongly influenced by the marine environment and can be distinguished by a branching channel pattern in a broad, flat valley. The stream channel gradient is near 0 feet per mile with the result that weak currents deposit silt and mud in the stream bed.

512 Pastoral Zone

A sinuous channel pattern, characteristic of the pastoral zone, meanders through broad valleys with gently sloping walls. Sand and silt are deposited in the stream bed along the channel which slopes approximately 5 feet per mile. Oxbow lakes, which represent river channels cut off from the main stream course, are typical in this zone.

513 Floodway Zone

A braided channel pattern cutting through a narrow valley with terraced walls. Gravel and sand, which form frequent point bars, are the predominant bed material along the stream channel which drops 5 to 25 feet per mile.

514 Boulder Zone

A single, fixed channel forming a steep-walled, V-shaped valley is characteristic. Strong currents flow along channel gradients which drop more than 25 feet per mile. Scouring action in this zone creates a cobble and boulder streambed and transports finer sediments to lower segments of the stream course.

515 Intermittent Stream

Streams which lack a sufficient watershed to sustain year-round flow and are thus distinguished from other flowing waters. Although abbreviated, zonation does occur along the stream course and resultant geo-hydraulic features will be similar to larger streams.

52 Lake/Pond

Permanent standing water habitats are numerous in the recently glaciated Pacific Northwest. They occur in local depressions of varying depth and may or may not contain emergent vegetation. They are also numerous in the form of oxbows along the Snohomish River basin.

Most of the ponds found in the Snohomish River basin are oxbows, U-shaped bends in rivers which have been cut off from the river channel. A common oxbow in the study area is filled with yellow water-lily (Nuphar sp.) with cattail around its margin and willows on the bank surrounding the cattails. They are important habitats for waterfowl, shorebirds, aquatic mammals, amphibians, fish and species which are associated with marshes, swamps and riparian vegetation. Loss of these habitats would be detrimental to almost all species of animals found in the Snohomish River basin. For this reason, they are some of the most critical habitats found in the study area. (A list of animals seen in this type is given in Table B-1.)

521 Lake

For mapping purposes, those with a surface area greater than 20 acres. Open water areas are relatively large compared to nearshore zones and are usually the primary producing regions for the lake.

*522 Inland Pond

Standing water with a surface area less than 20 acres situated at higher elevations than the beach fringe or river delta. Ponds are typically shallow; therefore, the nearshore zone is an important primary producing area.

523 Coastal Pond

Standing water of less than 20 acres which are located along the beach fringe behind drift logs and at the base of shoreline bluffs. Coastal ponds also form on river deltas when old stream channels are blocked by levees or natural stream course shifts.

524 Beaver Pond

Standing water formed along small streams by the damming activities of beavers.

525 Farm Pond

Created by damming a stream or through excavation by man.

*526 Fish Rearing Facility

Rearing ponds for juvenile salmon.

53 Reservoir

These bodies of water will differ from natural lakes due to several factors, including basin geomorphology, controlled discharge and resultant fluctuating water level.

Reservoirs are not found in the study area.

*54 Bay/Estuary

This category includes moderately protected marine embayments commonly referred to as bays, harbors, inlets and coves. They have free connections with the open sea; wind and wave action is modified by protective uplands, and freshwater inflow creates variable salinities. Bluffs, beach substrates, marshes, eelgrass beds and other intertidal habitats associated with these embayments are greatly affected by upland, freshwater and marine influences and should be viewed as integrated communities, not as individual habitat types.

Bays and estuaries are dynamic natural systems. Important aspects of these systems are their high productivity and the extremely diverse life forms they support. The delicate balance and operations of these areas is dependent on the interrelationships of complex natural processes that go on not only in the ocean and rivers but on land and in the atmosphere as well. Bays and estuaries are fragile environments, and seemingly modest alterations in the processes that govern them can cause major changes in the biota which they support.

55 Impoundment

Those portions of both marine and freshwater habitats isolated from marine waters by man-made obstructions.

Impoundments are not found in the study area.

56 Lagoon

Highly protected brackish or freshwater embayments formed when bars partially or completely close the opening to shallow bays.

Lagoons are not found in the study area.

561 Enclosed Lagoon

Completely enclosed lagoons form when freshwater inflow is too weak to maintain a channel through a bar.

562 Open Lagoon

Partially enclosed lagoons are common, being formed when freshwater inflow maintains a stream channel through bars formed by longshore deposition.

57 Blind Channel

Blind channels along streams and narrow marine inlets are included in this classification. They often result from abandoned stream channels which, unlike oxbow lakes and coastal ponds, have not been isolated from adjacent water masses.

Freshwater and marine channels are an important part of the estuarine system; since they allow the movement of tidal waters and, thus nutrients into the marshes. S pecifically, they are important feeding and resting areas for waterfowl aquatic mammals, Great Blue Herons, and anadromous fishes. For example, Congleton and Smith (1976) found that marine blind channels in the Skagit saltmarsh were heavily used for feeding by migrating chum and chinook fry.

*571 Freshwater Blind Channel

Inlets along streams which receive back-up water from the main channel. They are similar to standing water habitats, but maintain a more open connection with the parent stream. Freshwater vegetation is typically associated with the upland margin.

*572 Marine Blind Channel

Narrow inlets typically forming on river deltas, which receive tidal back-up water and very little freshwater run-off. Brackish and salt-marsh vegetation is common along the channel's margin.

58 Canal/Waterway

Those linear waterways created and maintained by dredging.

Canals and waterways are found in the study area but were not mapped for they were difficult to discern from aerial photographs.

59 Open Water

Those marine waters commonly referred to as Sounds, Straits and Reaches and include those waters of Hood Canal and the Pacific Ocean

other than bays and estuaries.

Open salt water of Puget Sound does not occur in the study area. However, its good quality has a direct effect on most wildlife of the Snohomish estuary and on all anadromous fishes using the entire Snohomish River basin.

6 Aquatic Lands

Designates those lands which are either covered by water or strongly influenced by adjacent waters (Fig B-1).

61 Aquatic Land-Forested

Areas that have surface or standing water during some portion of the year and are at least partially forested.

Swamps are some of the most diverse and biologically interesting areas in the Snohomish River basin. Inhabitants of the swamps include: Pileated Woodpeckers, Wood Ducks, Ruffed Grouse, Bald Eagles, black bear, and black-tailed deer. Also Deevy (1971), declares that the sulfate-reducing bacteria that function in the oxygen-free mud of swamps are the most valuable of all plant and animal members of aquatic communities. If this area is to be studied further, swamps should be one of the first habitat types studied. Their biological importance, community structure, and interrelationships within the entire river basin are primary considerations. Loss of swamps would be extremely detrimental to this area.

611 Intertidal Freshwater/Brackish Swamp

Fresh or brackish water inundates or raises the water table such that it strongly influences these areas during high tides. Examples of this habitat class are areas found along Ebey Slough and on the upland side of the Scirpus plant community found in the salt marsh. Often it marks the upper boundary of aquatic lands. Common plant species found in this class are Sitka spruce, honeysuckle (Lonicera involucrata),cattail, and goldenrod (Solidago sp.)

*6111 With Picea

This habitat class is defined by the presence of Sitka spruce.

*6112 Without Picea

This habitat class is defined by the absence of Sitka spruce.

612 Freshwater Swamp

Those areas which usually have some open water (at least seasonally) relatively dense vegetation and level terrain. Tidal water does not infiltrate these areas. Snags occur occasionally, and a dense shrub cover is associated with the swamp margins. Common plant species are willow, alder, western red cedar, Sitka spruce,

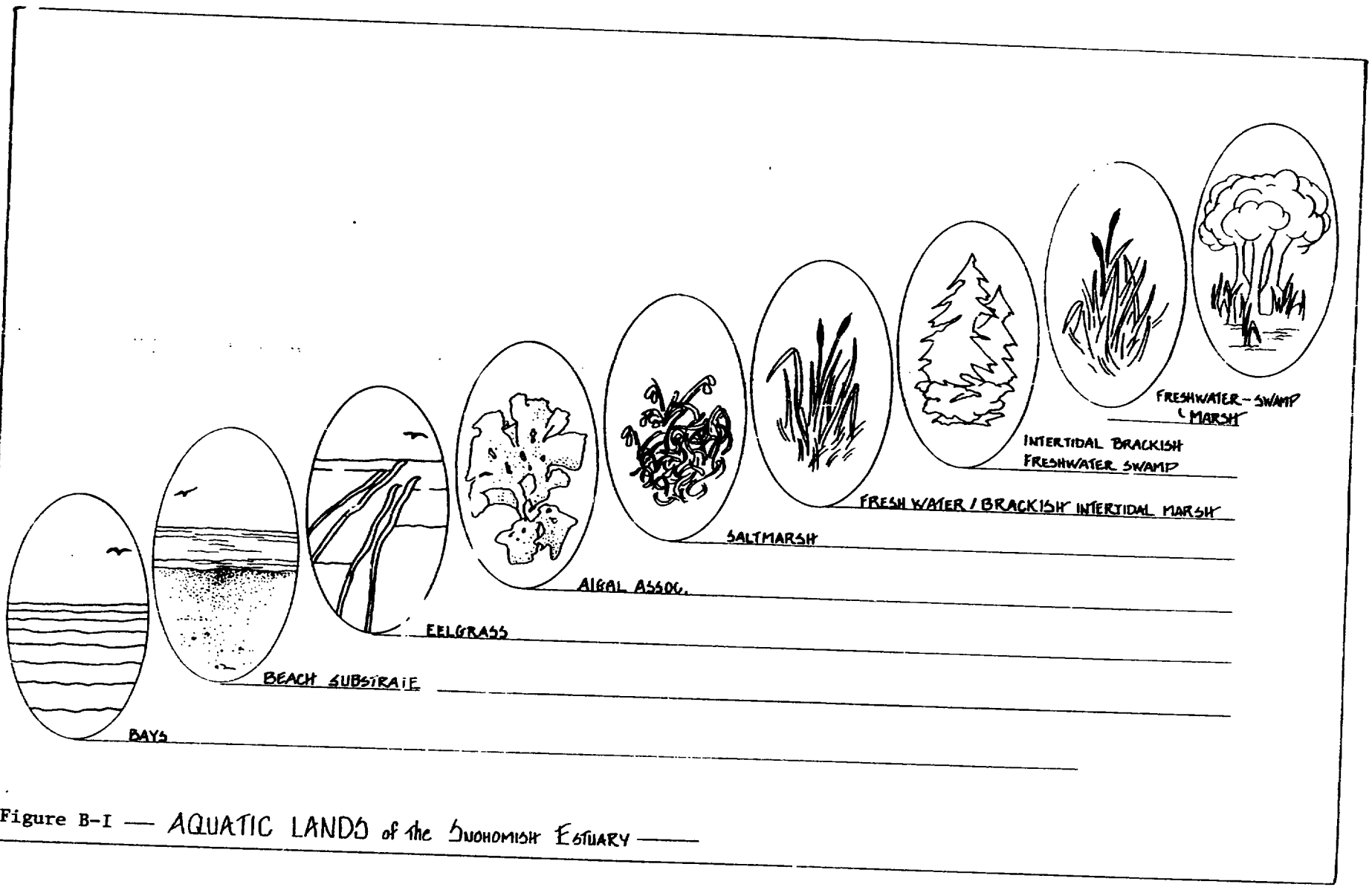

Figure B-I — AQUATIC LANDS of the Snohomish Estuary ——

lodgepole pine (Pinus contorta), and ninebark (Physocarpus capitatus).

*6121 With Picea

This habitat class is defined by the presence of Sitka spruce.

*6122 Without Picea

This habitat class is defined by the absence of Sitka spruce.

*62 Aquatic Land-Vegetated Nonforested

That portion of the wetlands which is non-forested but may be densely vegetated, e.g., marshes, bogs, meadows, and intertidal areas.

Estuaries rank along with rain forests and coral reefs as some of the most productive ecosystems known to man. The major contributors of the primary productivity within the estuarine system are marine plant communities (ie., kelps, eelgrass, other algal associations and salt marshes). Thus, they are also the major contributors of organic matter in estuaries. There are tw ways in which this organic matter is used by animals. Plants are either grazed directly by herbivores, or second, the organic matter is used by detritus feeders which eat dead or decaying plant material. These plants are also important to animals as a substrate to live on and as cover for refuge from predators. A specific example of their use is eelgrass which is used as a substrate, as direct food for a small number of herbivorous species, as food for detritivores, as a stabilizer for a mud substrate, and as cover for organisms requiring quiet or silt-free water, (Phillips 1974).

Marine plant communities form the basis for some of the most complex food webs known to man. Because of their complexity any destruction of these plant communities will negatively effect the biota of the entire estuary and the upper Snohomish River basin.

Further upstream from the estuary, vegetated, nonforested aquatic lands are composed of entirely freshwater marshes. Like marine plant communities, freshwater marshes also tend to be naturally fertile systems (Odum, 1971). Due to the lack of tidal action and flowing water, they affect a smaller area than marine plant communities and thus, support less complex food chains. However, they are used by a large number of wildlife species (i.e., beaver, muskrat, otter, coyotes, raptors, waterfowl, song birds, Great Blue Herons, fish, benthic invertebrates and amphibians). Some of these species live almost exclusively in marshes, while others are dependent on marshes to some degree.

One of the most valuable uses of marshes is their ability to moderate extreme highs and lows in stream flow.

621 Nereocystis Communities

The kelps (Nereocystis spp.) are a group consisting of large brown algae which are often a conspicuous component of the shoreline.

Kelp is found where rock, cobble, or coarse gravel substrates are present; and exists in both the lower intertidal and shallow subtidal regions. Due to its size, it can easily be discerned from aerial photographs and is mapped in both the intertidal and shallow subtidal. No kelp beds were found in the Snohomish study area.

*622 Other Algal Associations

Algal communities in intertidal areas are composed of green, brown and red algal types. Certain types may be separated on the basis of substrate types and tidal levels.

*6221 Ulvoids

Green algae occurring mainly in the low to mid tide range in large mats. Characteristically occurs in spring and in sheltered areas during the summer.

6222 Laminarian

Brown, flat-bladed algae of from one to four feet in length occurring in low intertidal to subtidal area. Present mainly during late spring through fall in both exposed and protected areas.

6223 Fucoids

Brown, short algae occurring year round in both exposed and protected areas at the mid to high tide levels.

*623 Eelgrass (Zostera spp.)

These are vascular plants which grow in the marine environment. Two species of eelgrass occur in the study area--Zostera marina and Z. noltii. Eelgrass species cannot usually be differentiated with photo-interpretation techniques.

624 Salt Marsh

Salt marshes are beds of rooted intertidal vegetation which are alternately inundated and drained by tides. All salt marsh plants collected in the study area are listed in Table B-2. The seven salt marsh vegetation types found in the study area are depicted in Figure B-2.

*6240 Other

A salt marsh type which does not fit into the following categories.

*6241 Carex

A plant community in salt marsh dominated by Lyngby's sedge (Carex lyngbei). This community occurs primarily along the

edges of Ebey and Steamboat Sloughs.

*6242 Triglochin - Carex

A plant community where seaside arrowgrass (Triglochin maritimum) and Lyngby's sedge are dominant. Percent cover of species occurring along line transects was: seaside arrow-grass (63 percent), Lyngby's sedge (31 percent), salt grass (Distichlis spicata)(10 percent), Pacific silverweed (Potentilla pacifica) (trace), Baltic rush (trace), tufted hairgrass (Deschampsia caespitosa) (trace), lilaeopsis (Lilaeopsis occidentalis) (trace), Lesser cattail (Typha angustifolia) also occurred in this type but not on line transects.

*6243 Carex - Potentilla - Agrostis - Triglochin - Deschampsia

A plant community where Lyngby's sedge, Pacific silverweed, bentgrass, seaside arrowgrass, and tufted hairgrass are dominant. Percent cover of species occurring along line transects was: Lyngby's sedge (53 percent), Pacific silverweed (24 percent), bentgrass (16 percent), seaside arrowgrass (one percent), tufted hairgrass (two percent), Baltic rush (trace), and lilaeopsis (trace). Seaside arrowgrass and tufted hairgrass are considered dominant because of size of individual plants.

*6244 Juncus - Potentilla - Agrostis - Triglochin - Deschampsia

A plant community where Baltic rush, Pacific silverweed, bentgrass, seaside arrowgrass, and tufted hairgrass are dominant. Percent cover of species occurring along line transects was: Baltic rush (48 percent), Pacific silverweed (19 percent),bentgrass (18 percent), seaside arrowgrass (12 percent), tufted hairgrass (1 percent), lilaeopsis (trace), meadow barley (Hordeum brachyantherum) (trace), Douglas aster (Aster sub-spicatus) (trace) Lyngby's sedge (trace) and bulrush (trace). Tufted hairgrass was included in the name of this community because of its dominant height.

*6245 Disturbed Carex

Continual disturbance by drift logs, not by other types of disturbance, create this diverse salt marsh community. Common plants in this type are Lyngby's sedge, Pacific silverweed, common silverweed, Douglas aster, common orache (Atriplex patula), tufted hairgrass, bentgrass, meadow barley, bulruch, common cattail, seaside arrowgrass, and meadow goldenrod (Solidago canadensis).

*6246 Scirpus

A monotypic community dominated by bulrushes (Scirpus acutus or S. validus).

*6247 Salicornia

A salt marsh characterized by the presence of pickleweed (Salicornia virginica). Pickleweed was found only on Jetty Island and shoreline of Tulalip Bay. Associated plants are Lyngby's sedge, sea-

Table B-2 Plants found growing in salt marshes of the Snohomish River estuary.

Scientific Name	Common Name
Agrostis alba	Bentgrass
Atriplex patula	Common Orache
Aster subspicatus	Douglas' Aster
Carex lyngbyei	Lyngby's Sedge
Cotula coronopifolia	Brass Buttons
Delphinium sp.	Tufted Hairgrass
Distichlis spicata	Saltgrass
Glaux maritima	Saltwort
Hordeum brachyantherum	Meadow Barley
Jaumea carnosa	Jaumea
Juncus balticus	Baltic Rush
Lilaeopsis occidentalis	Lilaeopsis
Plantago maritima	Seaside Plantain
Potentilla anserina	Common Silverweed
Potentilla pacifica	Pacific Silverweed
Ranunculus cymbalaria	Seaside Buttercup
Rumex occidentalis	Western Dock
Salicornia virginica	Pickleweed
Scirpus acutus	Hardstem Bulrush
Scirpus americanus	Three-square Bulrush
Scirpus cernuus	Low Clubrush
Scirpus validus	Softstem Bulrush

Table B-2 continued

Sidalcea hendersonii	Henderson's Checker-mallow
Solidago canadensis	Meadow Goldenrod
Spergularia sp.	Sandspurry
Triglochin maritimum	Seaside Arrowgrass
Deschampsia caespitosa	Tufted Hairgrass

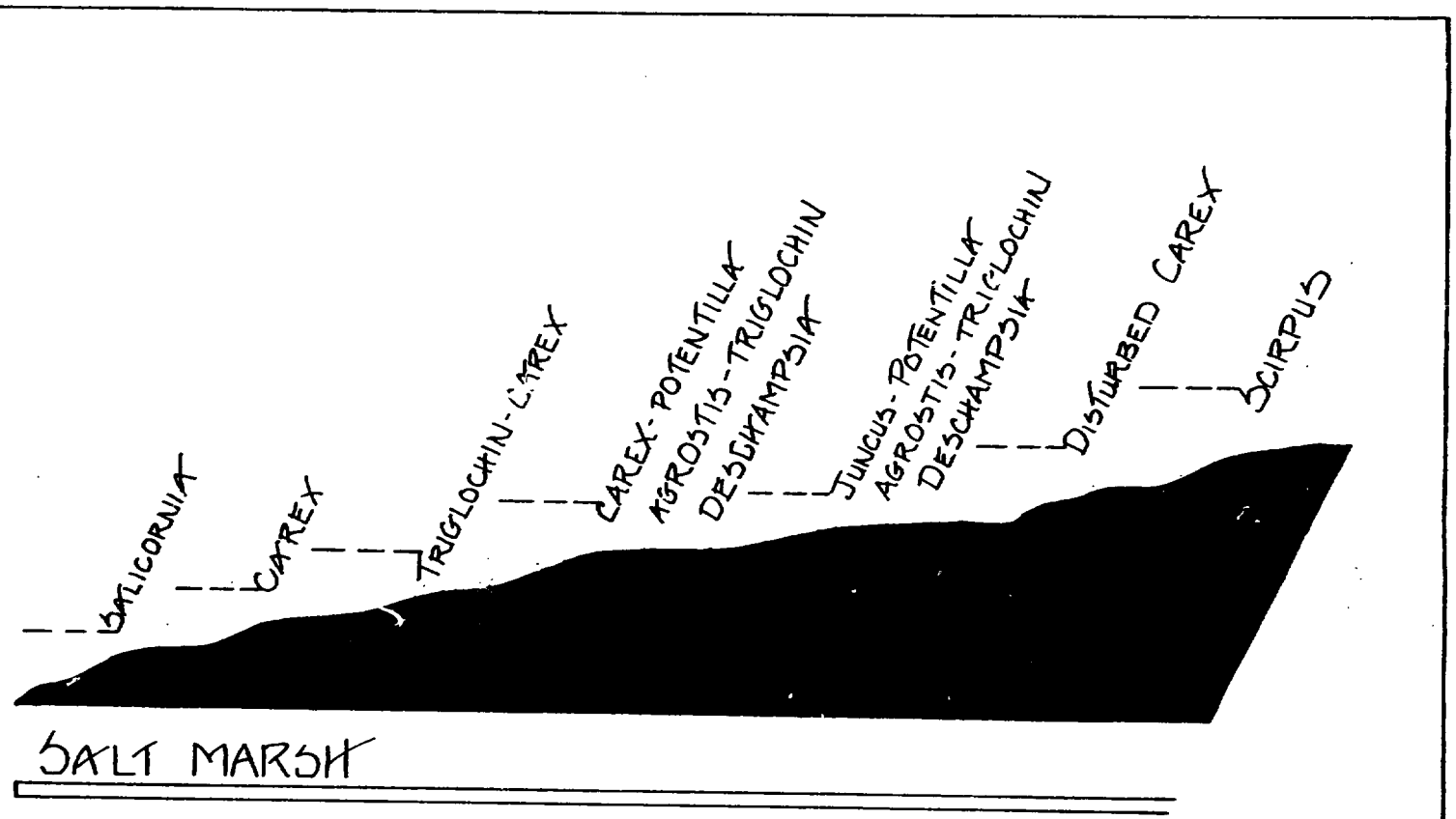

Figure B-2 Depiction of salt marsh communities of the Snohomish estuary as they occur along an elevational gradient.

side arrowgrass, saltgrass, seaside plantain (Plantago maritima), bentgrass, jaumea (Jaumea carnosa), Pacific silverweed, Baltic rush, lilaeopsis, and brass buttons (Cotula coronopifolia).

625 Brackish/Freshwater Intertidal Marsh

Low areas which have an influx of tidal water. These waters may be brackish or fresh. Characteristic vegetation included cattails, bulrushes, and sedges.

*6250 Other

A brackish/freshwater intertidal marsh type which does not fit into the other categories.

*6251 Scirpus

Marshes where bulrush (mostly Scirpus validus) is the dominant, if not only plant.

*6252 Scirpus - Typha

Marshes where bulrushes and common cattail have almost equal densities. Few other plants occur in this type.

*6253 Typha

Marshes where common cattail is the dominant or monotypic plant species.

*6254 Carex

A marsh which is dominated by Lyngby's sedge. This class is similar to the Carex habitat class (6241) in slat marshes in that it grows along the edge of the sloughs. The main difference is the water salinity.

626 Freshwater Marsh

Low areas or depressions which contain standing water for all or a portion of the year--not under marine influence. Characteristic vegetation consists of cattails, sedges, bulrushes, and other marsh plants.

*6260 Other

A freshwater marsh type which does not fit into the other categories.

*6261 Scirpus

Freshwater marshes where bulrushes are the dominant plants.

*6262 Typha

Freshwater marshes where cattails are dominant. In some areas, spirea may occur in equal densities, exemplified by the marsh directly on

the east side of the Highway 2 bridge over the Snohomish River.

*6263 Scirpus - Typha

Marshes where bulrush and cattail are co-dominant.

*6264 Juncus depression/pasture

Marshes which are pastured. The dominant plant is a rush (Juncus effusus).

*6265 Carex

Marshes where sedges are the dominant vegetation.

'63 Aquatic Land-Nonvegetated

Substrates which are important habitats for many benthic invertebrates.

Beach substrates are important biologically for the diverse benthic invertebrate community they support. These invertebrates are important sources of food for diving ducks, shorebirds, fish, and man.

631 Rock

Includes both solid bedrock and boulders which are too large to be constantly moved about by wave or current action. Rock habitats are most characteristic of high exposure areas (high degree of wave or current action), although they also occur in more protected environments. The occurrence of tidepools offers a unique habitat, generally characterized by an abundant and diverse community.

632 Cobble

Consists almost entirely of uniform-sized cobbles with very little sand or gravel present. The absence of smaller particles distinguishes this substrate from the mixed coarse class, and results from high energy wave conditions capable of moving even the cobbles. This biological community is characterized by a low species diversity with relatively few numbers of each species present.

633 Mixed Coarse

Consists of cobbles, gravel, and sand. Associated with moderate energy conditions but is occasionally found in lower energy areas; in this case, there is often some mud present. High species diversity and high numbers of organisms are associated with this habitat.

634 Mixed Medium

Includes beaches comprised of coarse gravel and sand occurring together and those beaches consisting of essentially pure coarse gravel. Mixed medium beaches occur along high energy shorelines. As with a cobble beach, the biological community has low numbers of individuals and low species diversity.

635 Mixed Fine

Composed of fine gravel, sand, and mud. Usually occurs in protected areas but occasionally in moderate energy areas and is associated with a rich, diverse biological community.

*636 Sand

Occurs in either highly or moderately exposed beaches. As a rule, the more protected the beach, the finer the sand particles. Coarseness of the sand greatly affects the associated biological community.

*637 Sand-silt or Muddy-sand

Fine sand and silt form a characteristic habitat in protected areas such as bays and estuaries. Contains a more diverse and abundant biological community than either a sand or mud habitat.

*638 Silt/Clay or Mud

Made up of very fine particles. As a result, this substrate is extremely soft and sometimes dangerous to walk in. Mud occurs only in areas where wave action and currents are extremely low, such as at the heads of bays and estuaries. Due to this location, mud is often associated with brackish waters.

7 Other Lands

Lands not identified in the rest of the classification system.

71 Spits

Shoreforms created when sand and other fine sediments eroded from cliffs or bluffs are carried by alongshore drift and deposited at bay mouths or coastal obstructions. Marsh and beach grassland vegetation typically invade the upper portions of these important resting areas for gulls and shorebirds.

The only spit in the study area is located in Tulalip Bay. Spits have significant value as resting sites for large numbers of animals, particularly birds. Their isolation and unobstructed view make them especially important for safety and freedom from disturbance. Numerous shorebirds, gulls, terns, waterfowl and harbor seals frequently can be observed on undisturbed portions of spits.

*711 Vegetated Spit

If the vegetated area of a spit is less than can be mapped at scale, the entire spit is designated a vegetated spit.

712 Nonvegetated Spit

The nonvegetated parts of larger spits and smaller spits.

*GB Gravel Bar

Bars which are formed along rivers and are composed primarily of gravel.

*SB Sand Bar

Bars which are formed along rivers and are composed primarily of sand.

The biological importance of gravel and sand bars is extremely varied. Both gravel and sand bars have back eddies formed downstream from them, which are used as resting areas for migrating salmonids. F or this reason they are also important recreational areas for fishermen. They both are used as nesting areas for killdeer, and spotted sandpipers. Also, if succession is allowed to proceed they will become vegetated and then, will be critically important riparian habitat types. Physically, the deposition of sand and gravel plays an important part in slowing down and spreading out flood waters.

Gravel bars, when submerged, are important substrates for aquatic insects, and most importantly, they are used as spawning areas for salmonid fishes.

Losses of sand and gravel bars will be detrimental to the biota of the Snohomish River basin.

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Appendix C

Area totals (acres and hectares) of all habitat classes found on the 6-1:6000 and 1-1:12000 base maps for the Snohomish River basin below the confluence of Ebey Slough with the Snohomish River.

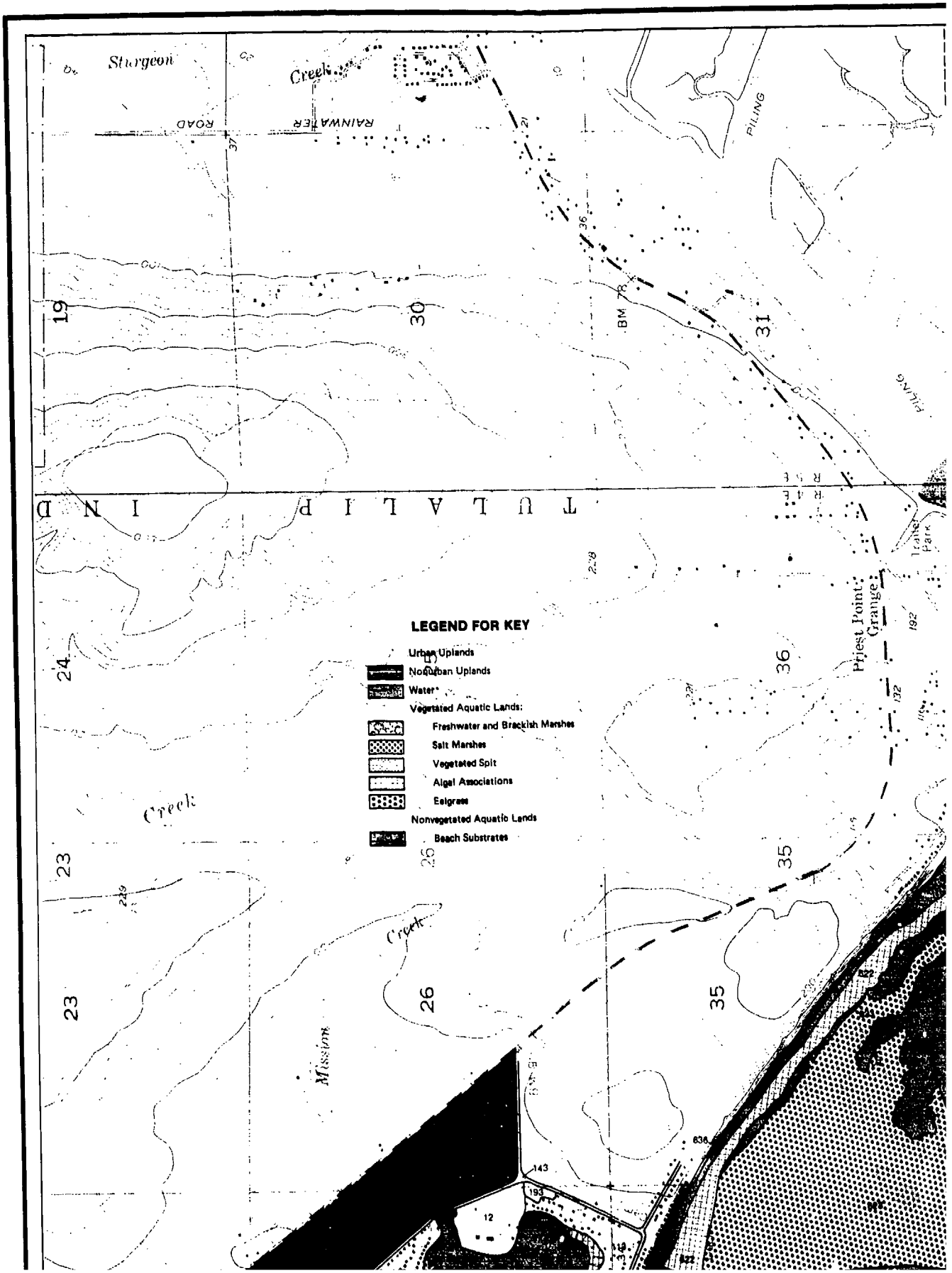
Habitat Type	1:6000 (Acres)	1:12000 (Acres)	Total (Acres)	1:6000 (Hectares)	1:12000 (Hectares)	Total (Hectares)
11	65.3	1.7	67.0	26.4	0.7	27.1
112	462.1	92.4	554.5	187.0	37.4	224.4
113	13.1	59.1	72.2	5.3	23.9	29.2
12	417.7	70.6	488.3	169.0	28.6	197.6
143	327.0	33.3	360.3	132.3	13.5	145.8
144	37.6	3.4	41.0	15.2	1.4	16.6
145	22.8		22.8	9.2		9.2
146	3.7		3.7	1.5		1.5
1480	36.3		36.3	14.7		14.7
1481	9.0		9.0	3.6		3.6
1482	250.4					
15		189.4	189.4		76.7	76.7
152	4.5	41.3	45.8	1.8	16.7	18.5
1531	195.0	10.3	205.3	78.9	4.2	83.1
1532	338.5	215.2	553.7	137.0	87.1	224.1
154	4.6		4.6	1.9		1.9
155	131.2		131.2	53.1		53.1
156	3.6	29.3	32.9	1.5	11.9	13.4
157		1.7	1.7		0.7	0.7
158	2.0	12.6	14.6	0.8	5.1	5.9
17	15.6		15.6	6.3		6.3
181	74.6	27.0	101.6	30.2	10.9	41.1
182	6.7	34.4	41.1	2.7	13.9	16.6
183	31.9		31.9	12.9		12.9
191	23.7		23.7	9.6		9.6
192	25.1		25.1	10.2		10.2
193	81.7	40.7	122.4	33.1	16.5	49.6
21	5323.5	9.8	5333.3	2154.4	4.0	2158.4
24	190.6	49.9	240.5	77.1	20.2	97.3
25	126.6		126.6	51.2		51.2
311	0.1		0.1	0.04		0.04
312		49.3	49.3		20.0	20.0
313	6.2		6.2	2.5		2.5
321	264.6	17.8	282.4	107.1	7.2	114.3
331	42.9		42.9	17.4		17.4
332	98.7		98.7	40.0		40.0
333	175.5		175.5	71.0		71.0
4120	14.8		14.8	6.0		6.0
4140	9.9	1.7	11.6	4.0	0.7	4.7
4210	17.2		17.2	7.0		7.0
4211	353.1	0.6	353.7	142.9	0.2	143.1
4220	28.6		28.6	11.6		11.6
4221	194.6	1.7	196.3	78.8	0.7	79.5
4230	22.0		22.0	8.9		8.9

4231	177.8	36.7	214.5	72.0	14.9	86.9
431	22.0		22.0	8.9		8.9
433	118.0		118.0	47.8		47.8
434	5.2		5.2	2.1		2.1
4612	2.2		2.2	0.9		0.9
4613	0.7		0.7	0.3		0.3
4621	72.0		72.0	29.1		29.1
4622	14.3		14.3	5.8		5.8
4623	9.3		9.3	3.8		3.8
511	1403.7	125.7	1529.4	568.1	50.9	619.0
522	17.7		17.7	7.2		7.2
526		1.1	1.1		0.4	0.4
54		1256.3	1256.3		508.4	508.4
571	68.9		68.9	27.9		27.9
572	13.6		13.6	5.5		5.5
6111	271.9		271.9	110.0		110.0
6112	227.4		227.4	92.0		92.0
6121	640.1		640.1	259.0		259.0
6122	59.6		59.6	24.1		24.1
62	6.0	0.6	6.6	2.4	0.2	2.6
622	1.1	190.0	191.1	0.4	76.9	77.3
6221		5.7	5.7		2.3	2.3
623		852.8	852.8		345.1	345.1
6240	3.3		3.3	1.3		1.3
6241	125.7	0.6	126.3	50.9	0.2	51.1
6242	56.5		56.5	22.9		22.9
6243	11.5		11.5	4.7		4.7
6244	134.3		134.3	54.4		54.4
6245	14.1	12.1	26.2	5.7	10.6	16.3
6246	63.0		63.0	25.5		25.5
6247		7.5	7.5	3.0		3.0
6250	12.5		12.5	5.1		5.1
6252	615.2		615.2	249.0		249.0
6253	36.0		36.0	14.6		14.6
6254	27.7		27.7	11.2		11.2
6260	34.2		34.2	13.8		13.8
6261	2.6		2.6	1.1		1.1
6262	21.8		21.8	8.8		8.8
6264	53.7		53.7	21.7		21.7
63	69.4		69.4	28.1		28.1
636	2.3	25.8	28.1	0.9	10.4	11.3
637	84.4	891.9	976.3	34.2	361.0	395.2
638	358.7	227.8	586.5	145.2	92.2	237.4
711		2.9	2.9		1.2	1.2
Grand Totals	14313.25	4630.7	18943.96	5792.5	1874.0	7666.5

Area totals (acres and hectares) of all habitat classes found on the 1:12000 base maps for the Snohomish River basin above the confluence of Ebey Slough.

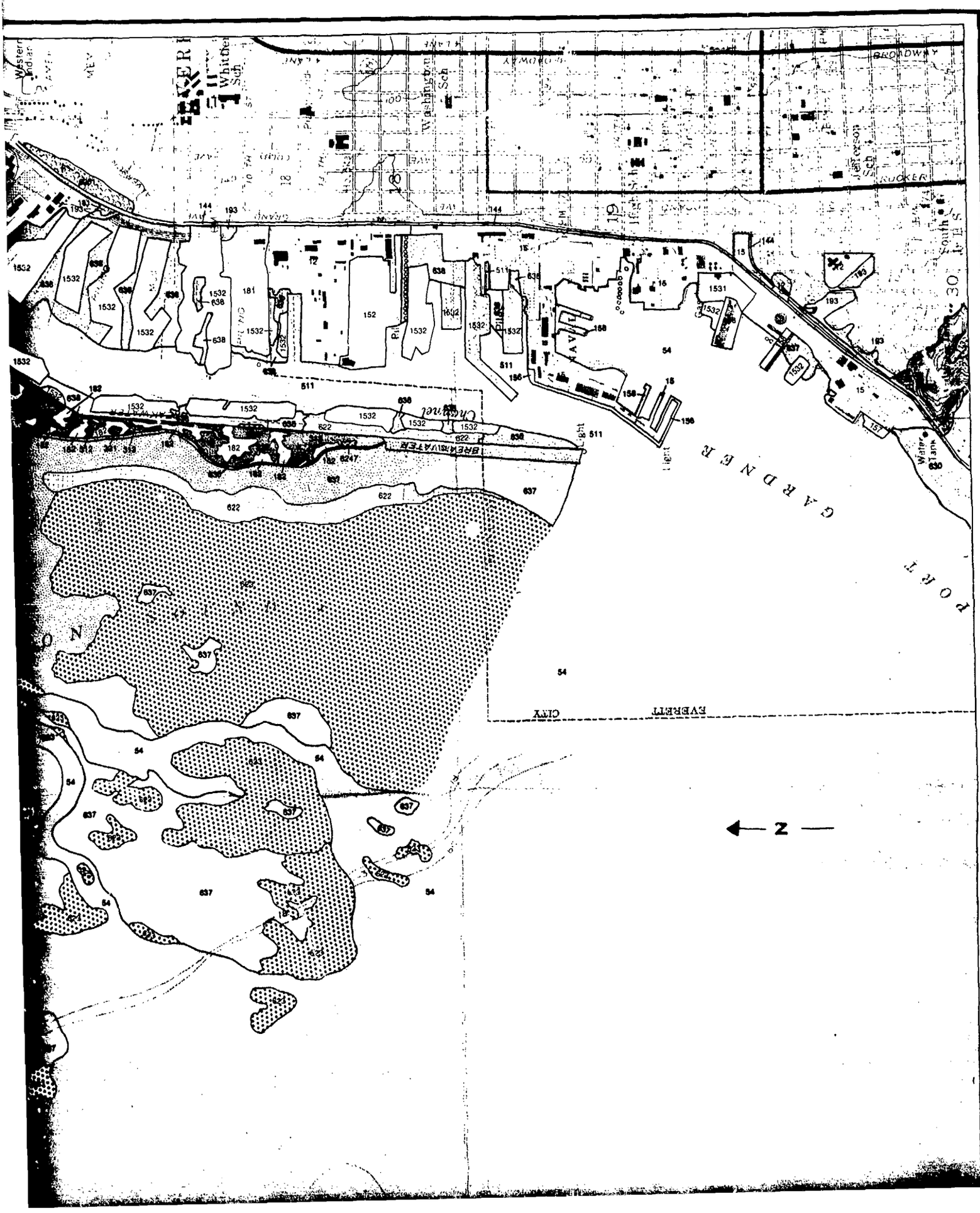
Habitat Type	SEW1		SEW2		SEW3		SEW4		SEW5		SEW6		SEW7	
	A	Ha	A	Ha	A	Ha	A	Ha	A	Ha	A	Ha	A	Ha
1					10.9	4.4	394.4	159.6						
111	6.3	2.5	48.2	19.5	14.9	6.0	20.6	8.3	27.5	11.1			27.5	11.1
112			102.7	41.5	4.6	1.8	138.9	56.2	4.0	1.6			188.5	76.3
113			12.0	4.8	13.2	5.3	2.3	0.9	10.3	4.2			27.5	11.1
12	4.0	1.6	32.1	12.9	2.3	0.9	112.5	45.5	10.3	4.2			45.3	18.3
141			42.4	17.2										
143	4.0	1.6	47.0	19.0	84.3	34.1	176.2	71.3	42.4	17.2	24.1	9.7	135.4	54.8
144	37.3	15.1	43.6	17.6			44.8	18.1	35.6	14.4				
145					1.1	0.4								
147							10.3	4.2						
1480													1.7	0.7
1482			9.2	3.7			5.2	2.1	0.6	0.2				
154	12.0	4.8	2.3	0.9			21.2	8.6					11.4	4.6
155											2.3	0.9	10.3	4.2
17					1.7	0.7	10.9	4.4	1.7	0.7				
181					2.9	1.1	1.1	0.4					5.2	2.1
19									5.2	2.1				
191													25.8	10.4
192			8.0	3.2										
193			10.9	4.4										
21	599.3	242.5	2457.8	994.6	1673.4	677.2	6305.1	2551.5	619.9	250.8	380.2	153.8	4138.6	1674.8
221											1.7	0.7		
223			2.4	0.9	4.0	1.6	6.3	2.5						
24	2.3	0.9	76.3	30.8	16.6	6.7	30.9	12.5	4.0	1.6	6.3	2.5	34.4	13.9
25	37.3	15.1	153.1	61.9	72.3	29.2	256.6	103.8	42.4	17.2	15.5	6.3	130.3	52.7
321	1.1	0.4	8.0	3.2	22.4	9.0	43.6	17.6	10.3	4.2	3.4	1.4	53.9	21.8
331			8.6	3.5			12.1	4.8	2.9	1.2	1.1	0.4	4.6	1.8
332			64.8	26.2			33.8	13.7					29.8	12.1
333	4.6	1.8	6.9	2.8	15.5	6.2	44.2	17.8	1.1	0.4	8.0	3.2	42.5	17.2
4130					1.1	0.4			0.6	0.2				
4131													2.9	1.2
4140													0.6	0.2

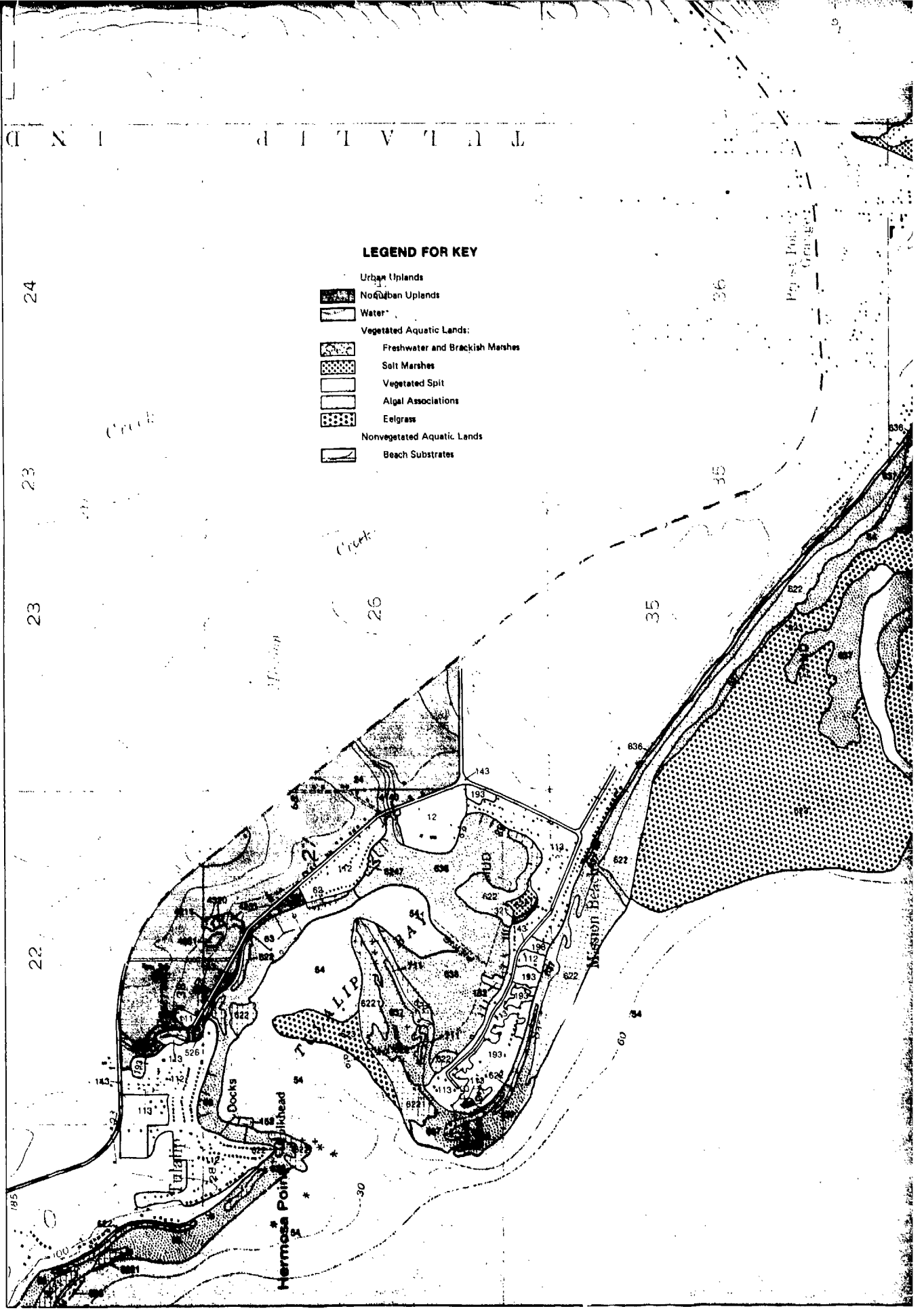
4210													5.2	2.1
4211	6.3	2.5	5.7	2.3	17.8	7.2	14.3	5.8	1.1	0.4			9.2	3.7
4221	9.7	3.9	29.2	11.8	20.6	8.3	102.1	41.3	4.6	1.8	16.6	6.7	125.1	50.6
4230			1.7	0.6									3.4	1.4
4231	3.4	1.4			189.9	76.7	92.4	37.4	12.6	5.1	18.9	7.6	106.7	43.2
4320					24.7	9.9							2.9	1.2
4321			8.0	3.2										
4330			4.6	1.8	56.2	22.7								
4331					1.7	0.7								
4341							9.2	3.7					39.6	16.0
44			8.0	3.2										
46			1.1	0.4										
4611			6.3	2.5									2.3	0.9
4613							2.3	0.9						
4621	17.8	7.2	49.9	20.2	52.2	21.1	170.4	68.9	29.8	12.1	6.9	2.8	72.9	29.5
4622	19.5	7.9	76.8	31.1	271.9	110.0	134.8	54.5	29.8	12.1	28.7	11.6	198.6	80.4
4623	9.2	3.7	66.5	26.9	720.8	219.6	1051.5	425.5	459.4	185.9	25.8	10.4	806.9	326.5
4633					5.2	2.1								
4710					1.1	0.4								
4720			19.5	7.9	103.2	41.8								
4730					3.4	1.4								
512	102.6	41.5	209.9	84.9	84.3	34.1	106.2	42.9			32.1	12.9		
513					305.1	123.5	234.1	94.7	9.2	3.7				
522							29.3	11.6	6.9	2.8	5.2	2.1	50.5	20.4
571	4.6	1.8												
6121			9.2	3.7			71.7	29.0			41.3	16.7	19.5	7.8
6122			4.6	1.8	22.9	9.3	137.1	55.5	8.6	3.5	21.2	8.6	110.7	44.8
6251	3.4	1.4	1.1	0.4										
6160							6.3	2.5			3.4	1.4		
6260			19.5	7.9	31.0	12.5	16.1	6.5					3.4	1.4
6262			5.7	2.3	5.7	2.3							53.9	21.8
6264					2.9	9.3	1.7	0.7	4.0	1.6			17.2	6.9
63			6.3	2.5										
SB	1.1	0.4	3.4	1.4									22.9	9.3
GB			25.8	10.4	127.9	51.7	95.8	38.7	83.7	33.9			52.7	21.3
Grand Total	884.7	358.0	3699.1	1497.0	3989.7	1614.6	9946.3	4025.3	1468.5	594.3	642.7	260.1	6619.8	2679.0


Sturgeon
Creek
RAINWATER
ROAD
PILING
BM
TULALIP
IND
LEGEND FOR KEY
Urban Uplands
Nonurban Uplands
Water
Vegetated Aquatic Lands:
Freshwater and Brackish Marshes
Salt Marshes
Vegetated Spit
Algal Associations
Eelgrass
Nonvegetated Aquatic Lands
Beach Substrates
Priest Point
Grange
Trailer Park
Creek
Mission
Creek
19
30
31
24
23
26
35
36

2


Preston Point
Whittier Sch
Washington Sch
Channel
BREAKWATER
Light
EVERETT CITY
SAND
Sand
P O S S E S S I O N
1532
637
622
54
182
511


BROADWAY
Washington Sch
Whitte Sch
Channel
BREAKWATER
PORT GARDNER
EVERETT
CITY
Light
Water Tank
South Jetty
2



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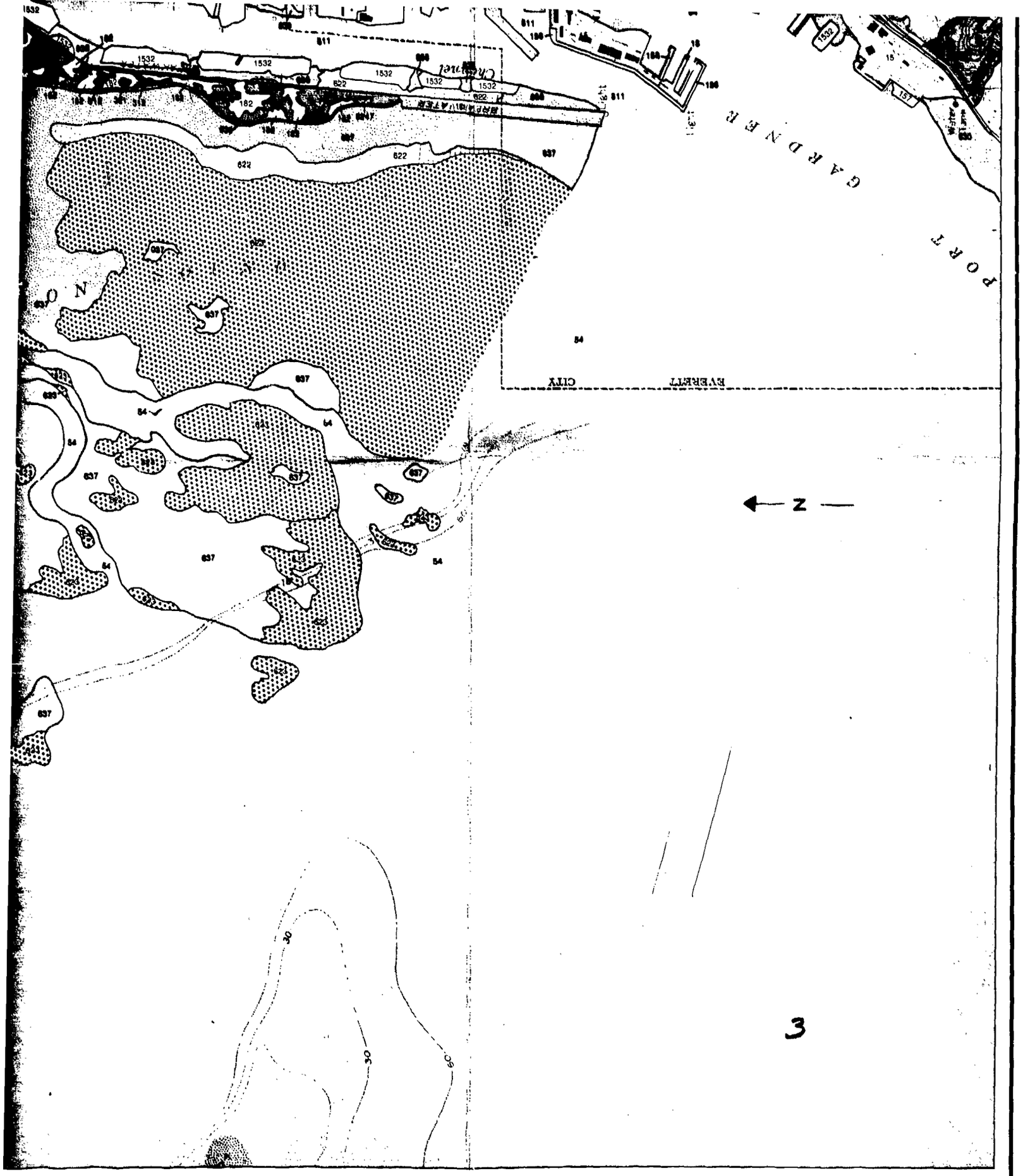
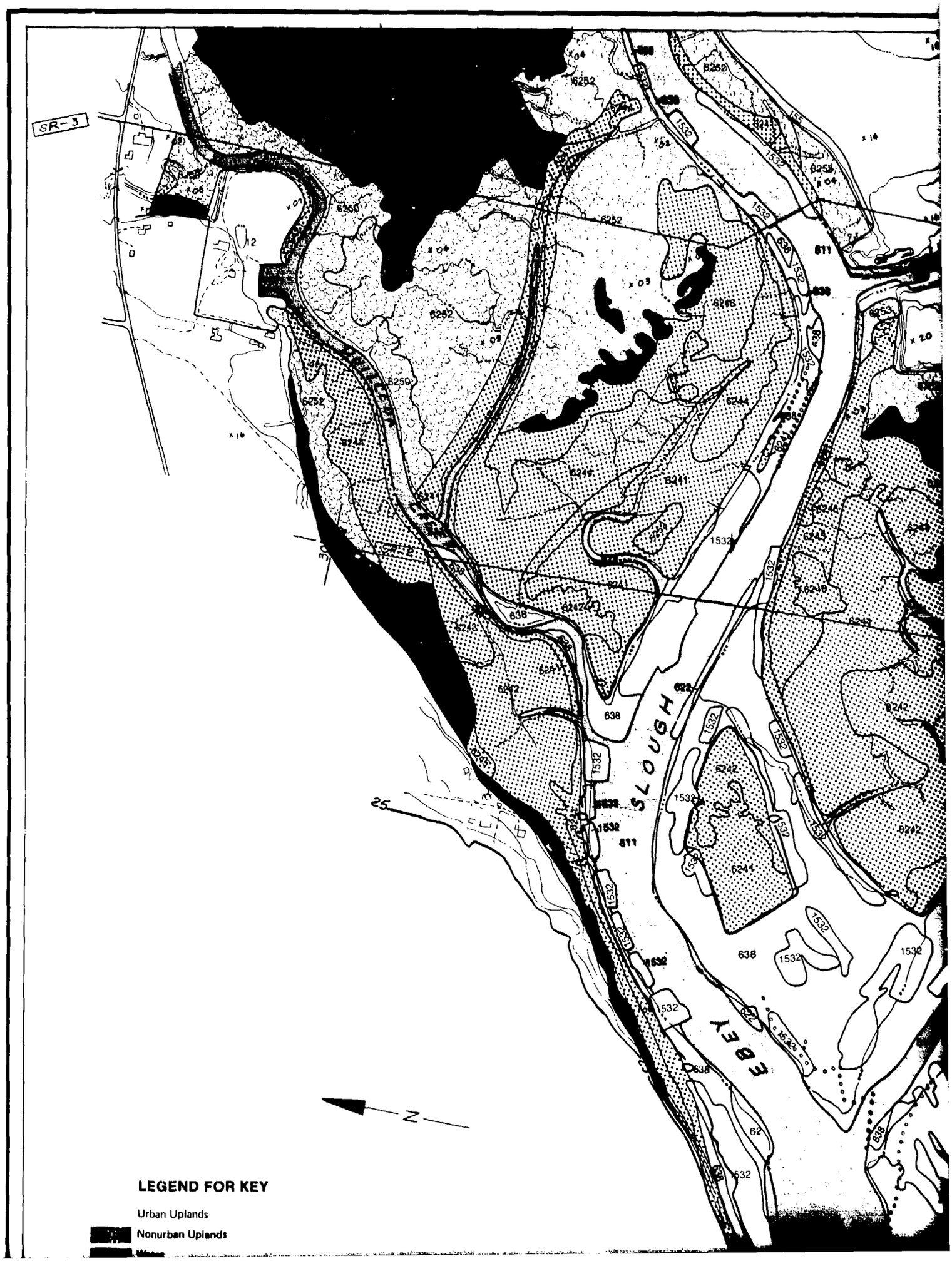
Classification and Mapping



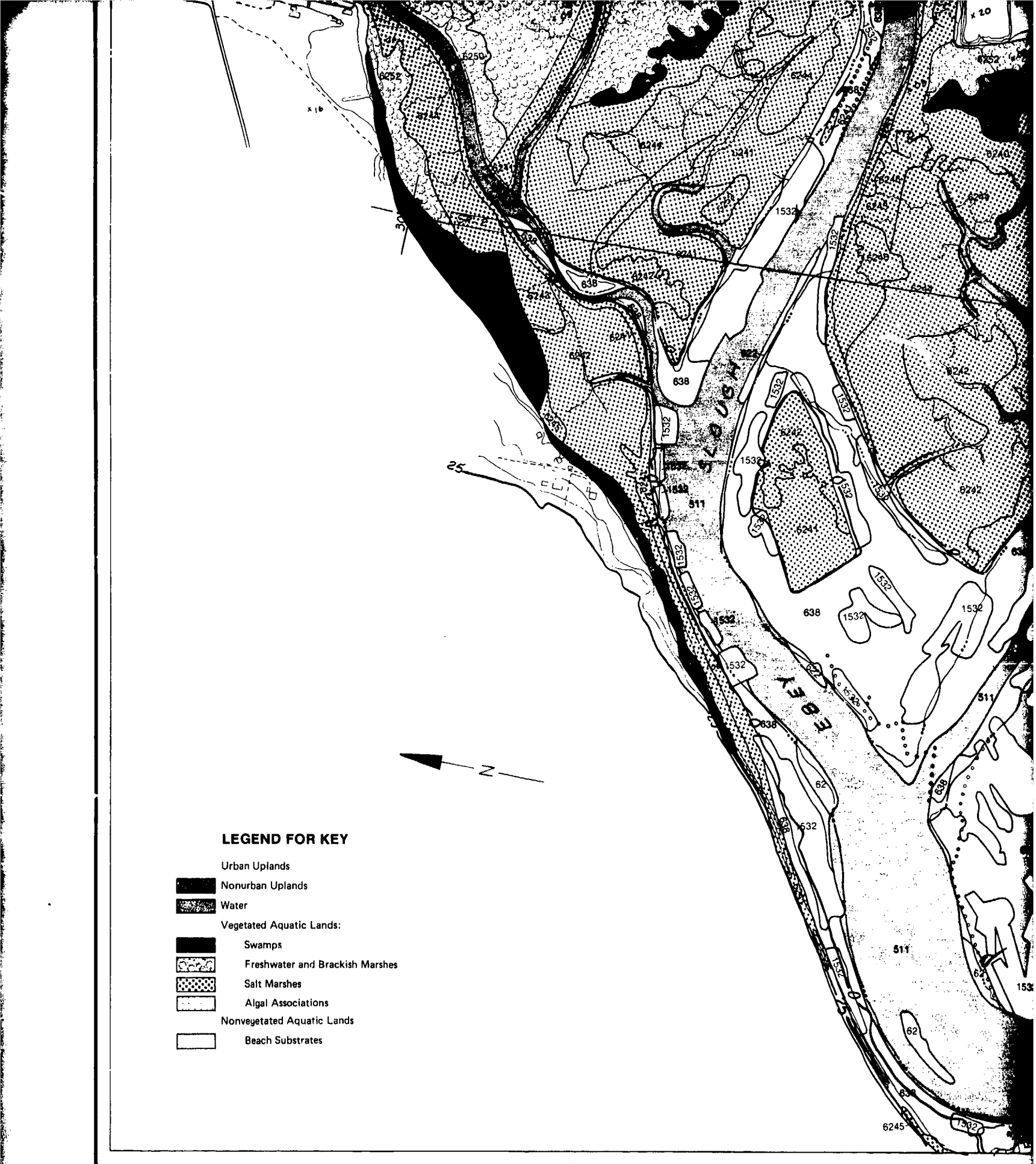
ISH ESTUARY WETLAND STUDY — 1978
Classification and Mapping

1


SR-3
SLOUGH
EBEY
LEGEND FOR KEY
Urban Uplands
Nonurban Uplands


2
MATCH TO SHEET NO. 2
SLOUGH
STEAMBOAT
SMITH ISLAND
SNOHOMISH
BAR
PILING
M·00


2
3
SLOUGH
STEAMBOAT
SMITH ISLAND
SNOHOMISH
RIVER
RANGE A
SR-2
SR-1
MATCH TO SHEET NO. 3
PILING
BREAK WATER
M-00


LEGEND FOR KEY
Urban Uplands
Nonurban Uplands
Water
Vegetated Aquatic Lands:
Swamps
Freshwater and Brackish Marshes
Salt Marshes
Algal Associations
Nonvegetated Aquatic Lands
Beach Substrates
N
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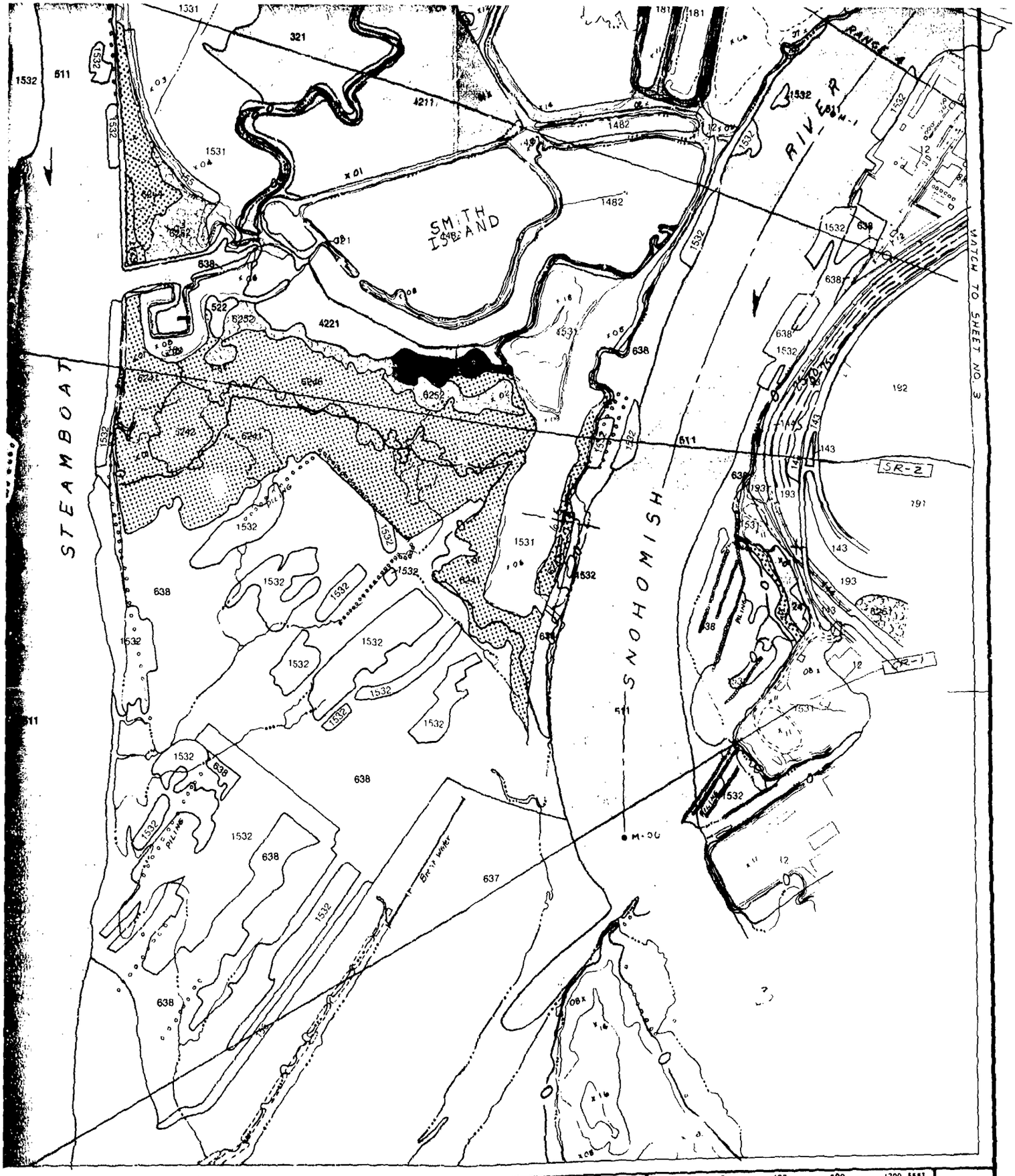
Classific. tion and Mapping

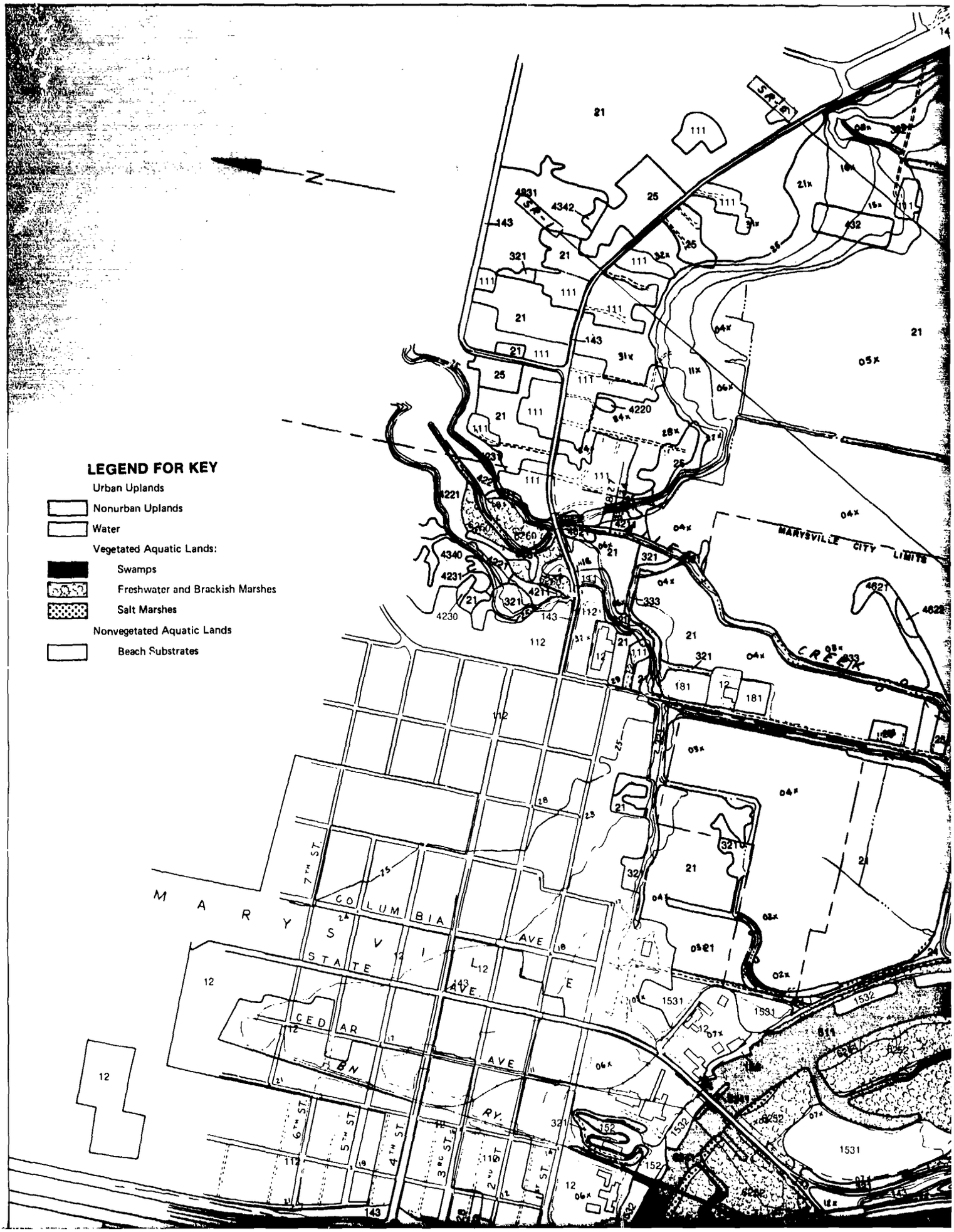
400 0

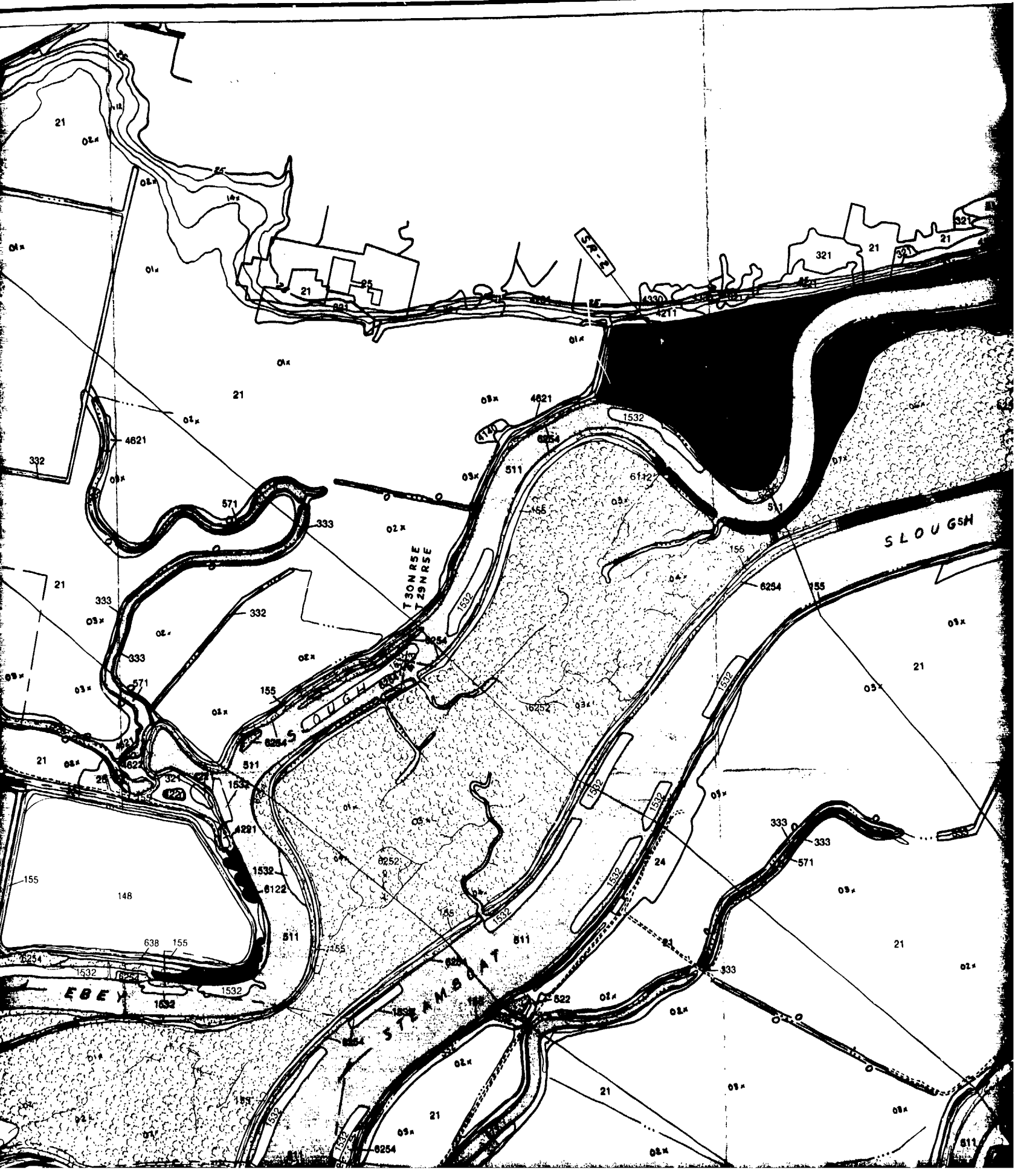


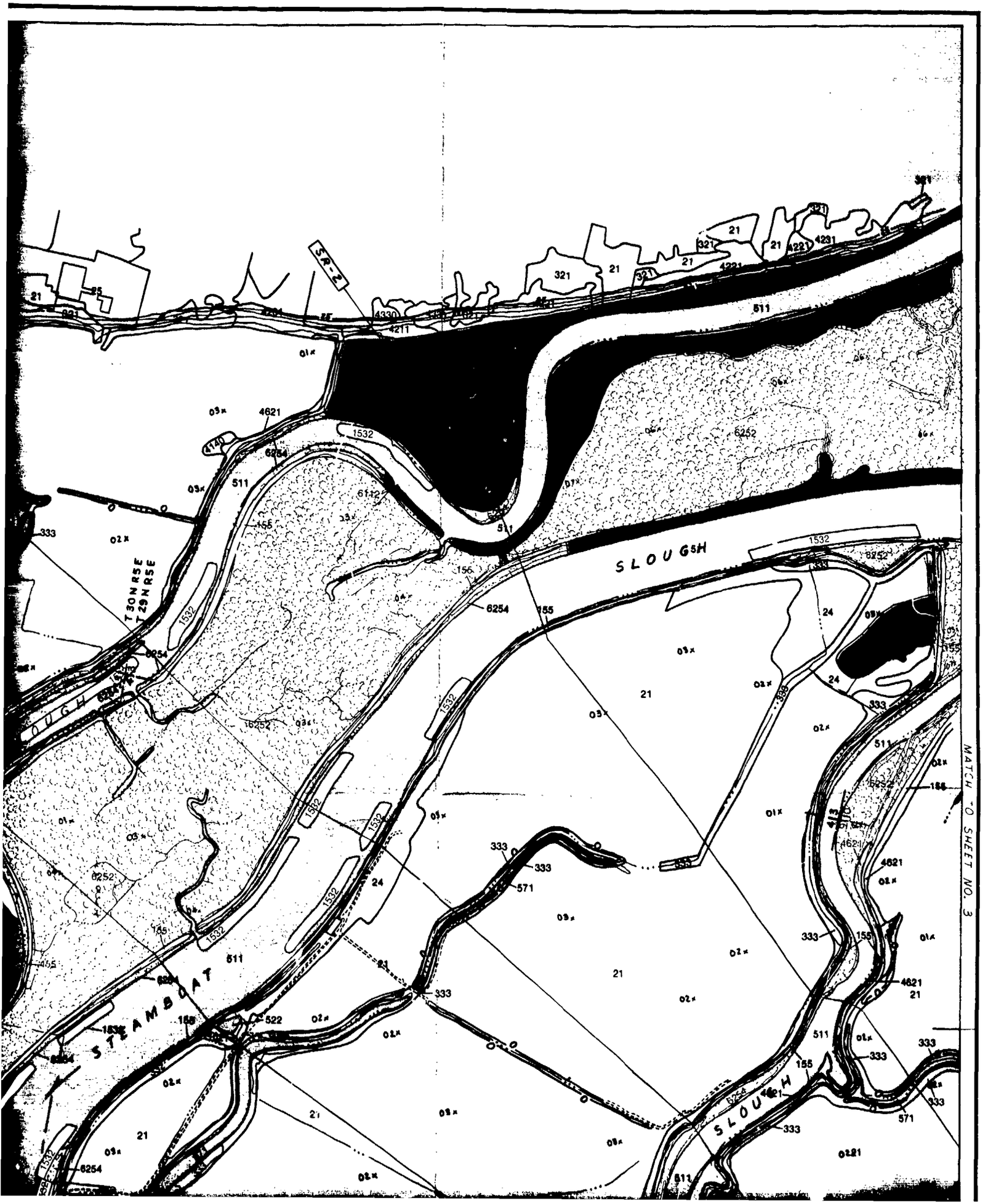
ESTUARY WETLAND STUDY — 1978

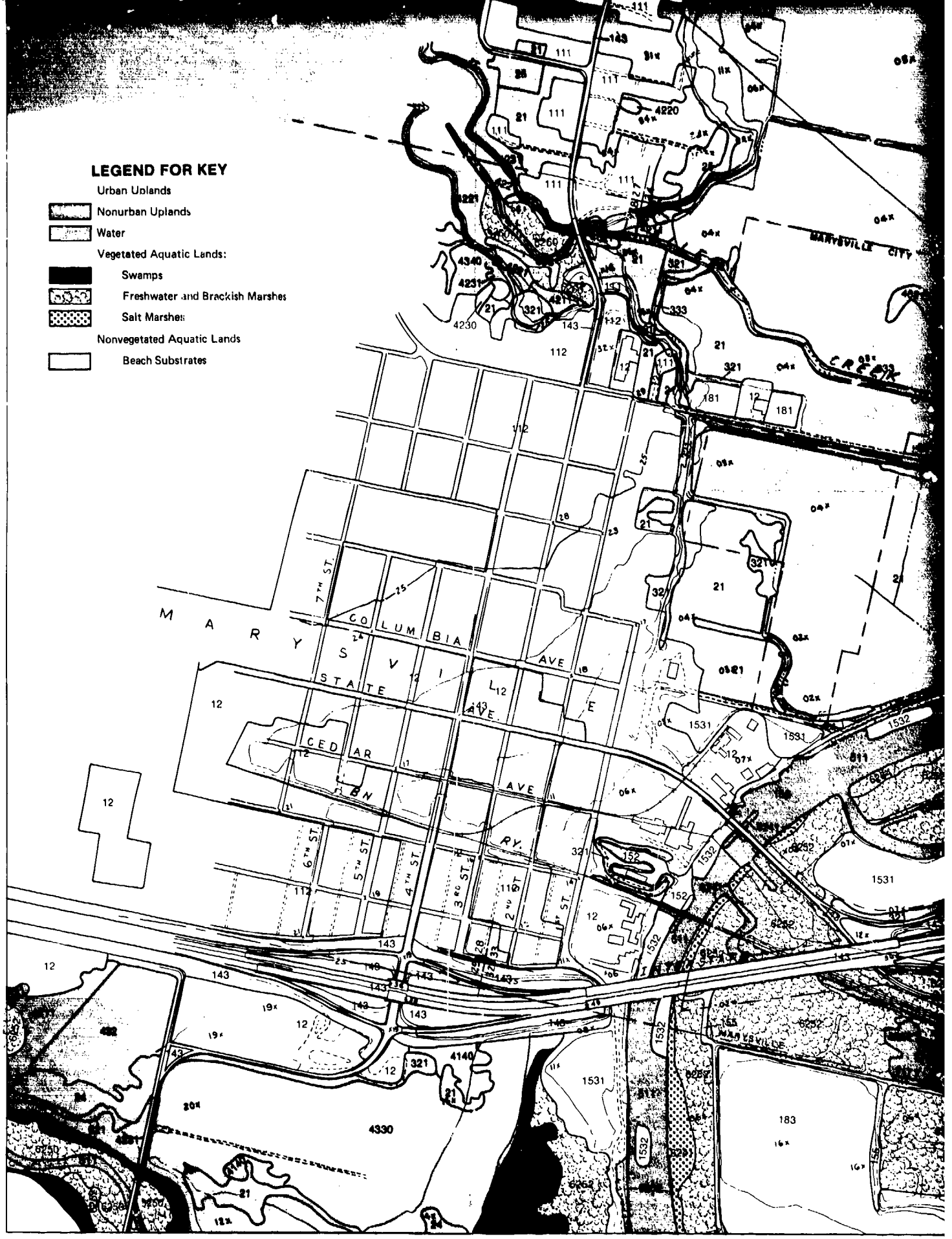
Classification and Mapping

2


LEGEND FOR KEY
Urban Uplands
Nonurban Uplands
Water
Vegetated Aquatic Lands:
Swamps
Freshwater and Brackish Marshes
Salt Marshes
Nonvegetated Aquatic Lands
Beach Substrates
MARYSVILLE CITY LIMITS
CREEK
MARYSVILLE
COLUMBIA AVE
STATE AVE
CEDAR AVE
7TH ST
6TH ST
5TH ST
4TH ST
3RD ST
2ND ST
1ST ST
RY.


SLOUGH
SLOUGH
STEAMBOAT
EBEY
T30N R5E
T29N R5E
SR 2


SR-2
SLOUGH
T30N R5E
T29N R5E
STEAMBOAT
SLOUGH
SLOUGH
MATCH TO SHEET NO. 3



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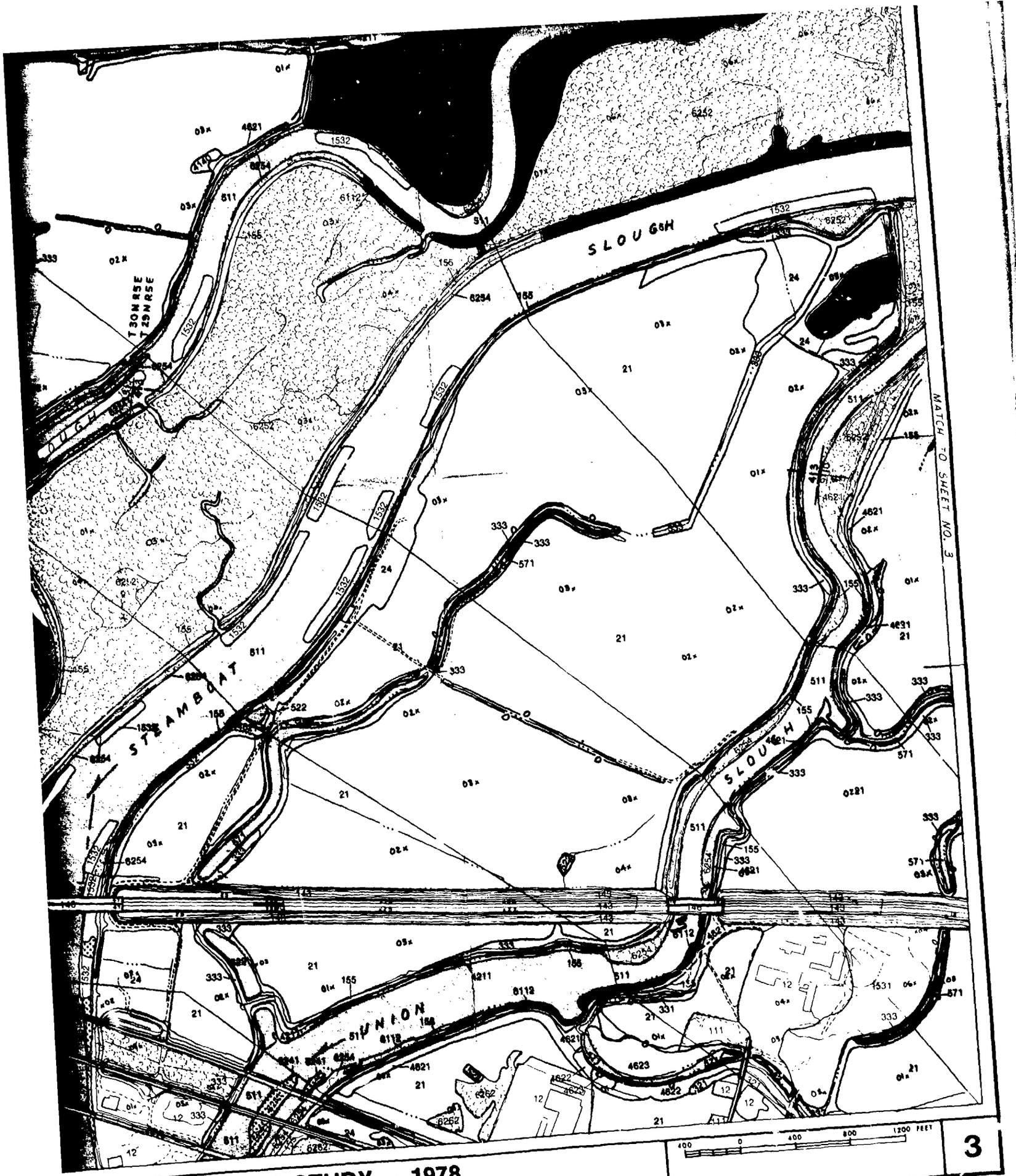
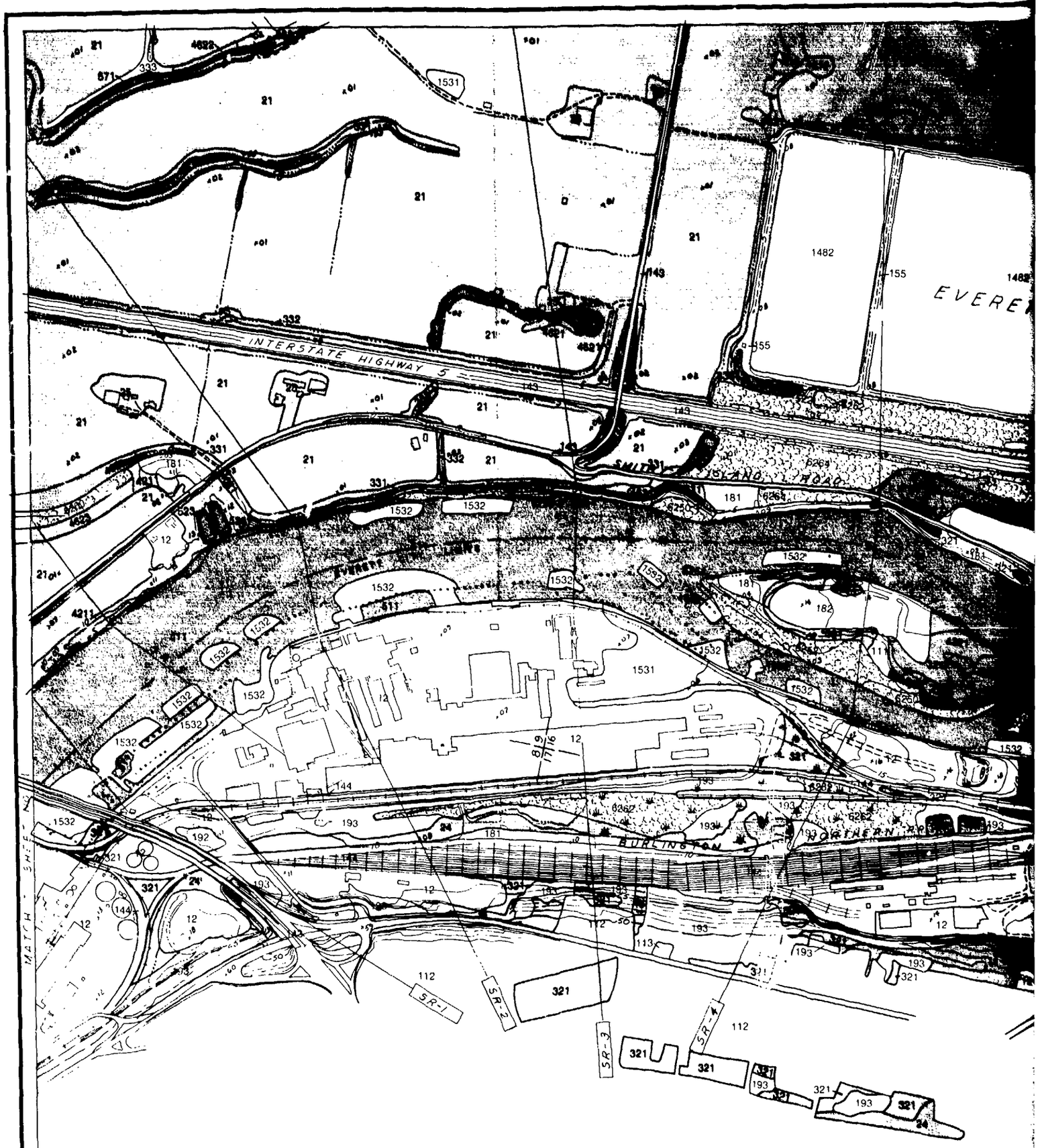
400



STUARY WETLAND STUDY — 1978

Classification and Mapping



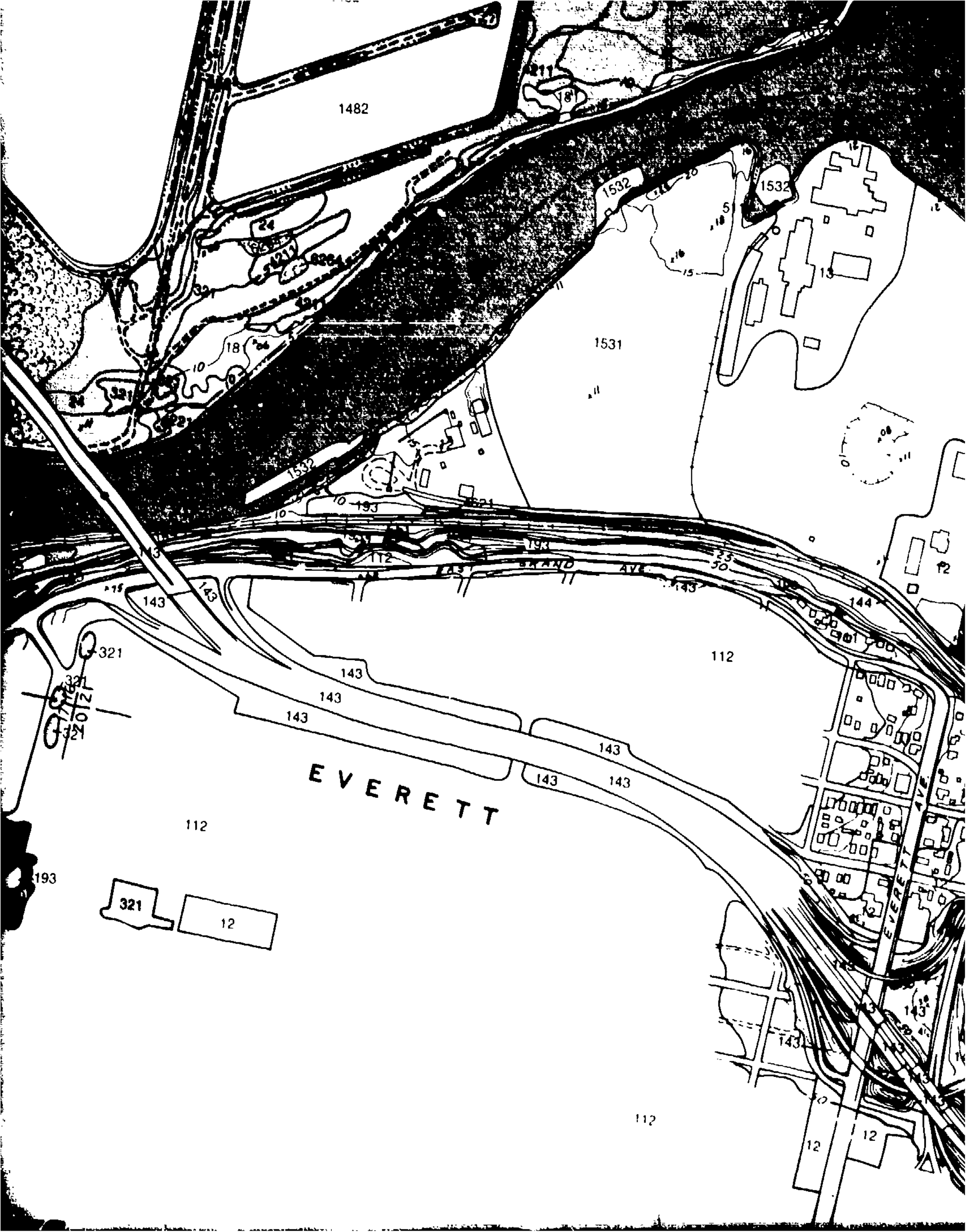
LEGEND FOR KEY

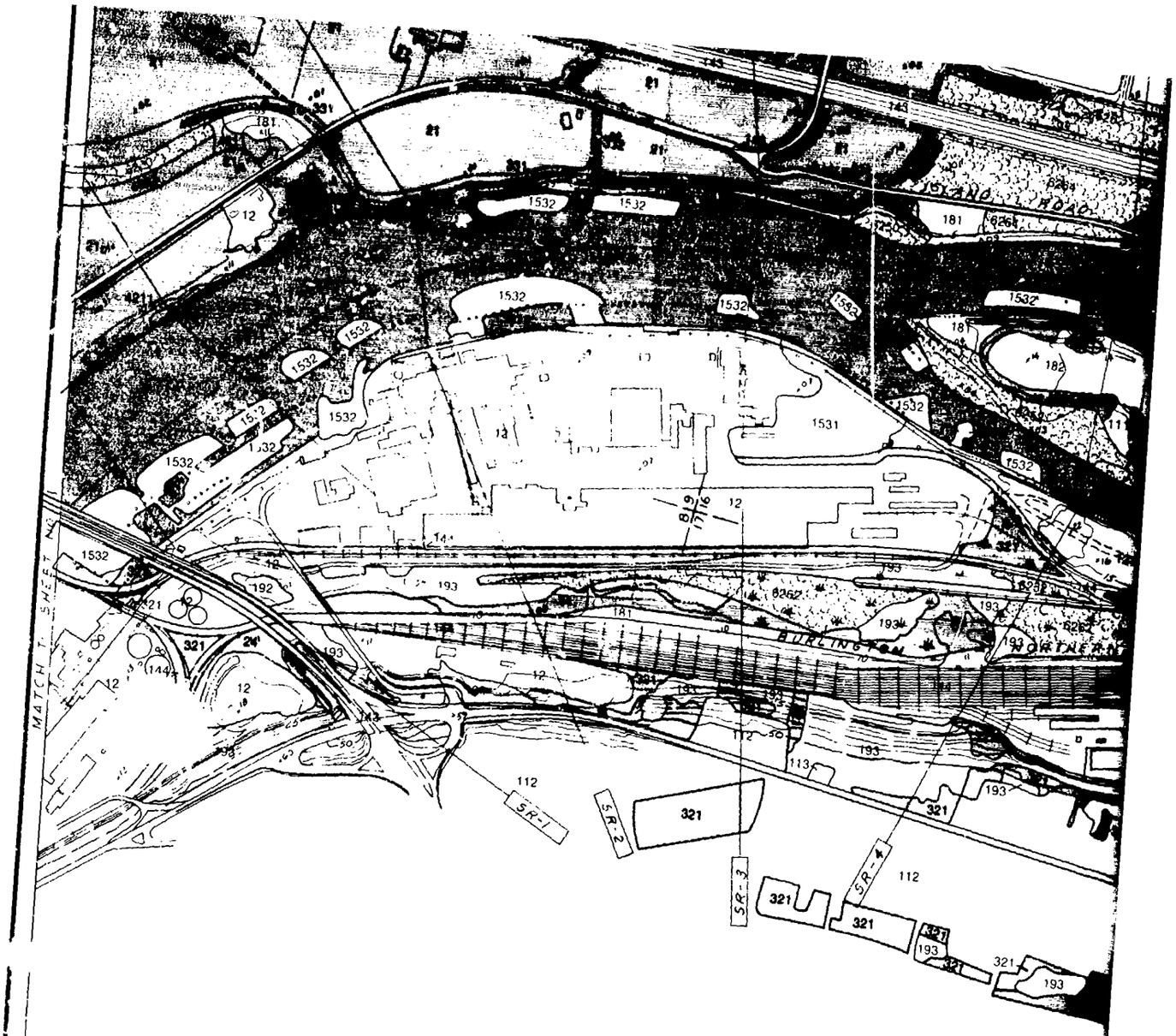
Urban Uplands

Nonurban Uplands

2


MATCH TO SHEET NO. 4
ERETT SEWAGE LAGOON
SNOHOMISH
EVERETT CITY LIMITS
EAST GRAND AVE
EVERETT
EVERETT AVE
1482
1532
4231
4211
21
321
333
155
17
511
143
112
193
191
12
13
1531


1482
1532
1532
1531
13
1532
193
321
143
EAST GRAND AVE
143
143
143
112
144
321
321
143
143
143
143
143
143
EVERETT
143
143
112
EVERETT AVE
193
321
12
143
143
112
12
12



LEGEND FOR KEY

- Urban Uplands
- Nonurban Uplands
- Water
- Vegetated Aquatic Lands:
  - Swamps
  - Freshwater and Brackish Marshes

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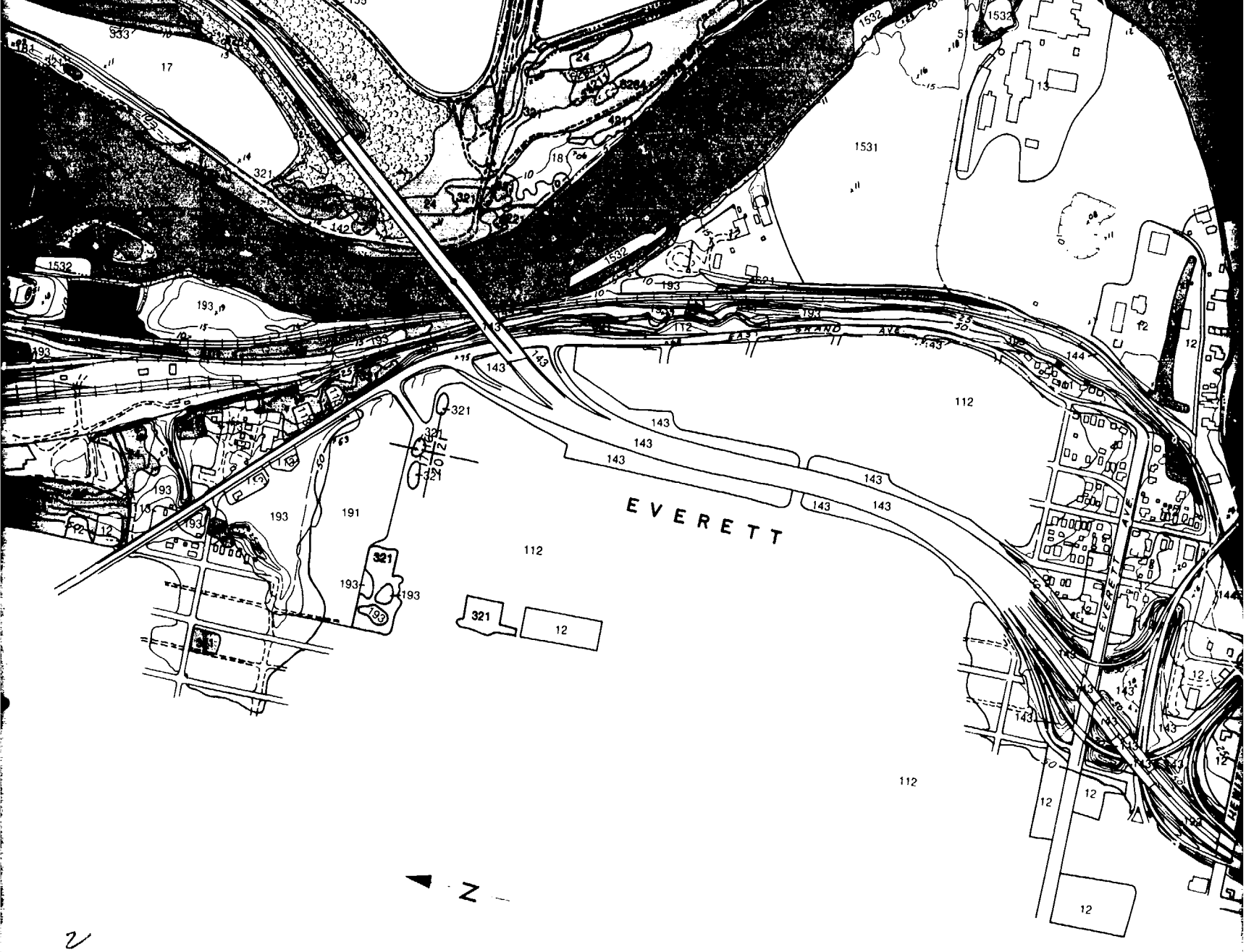
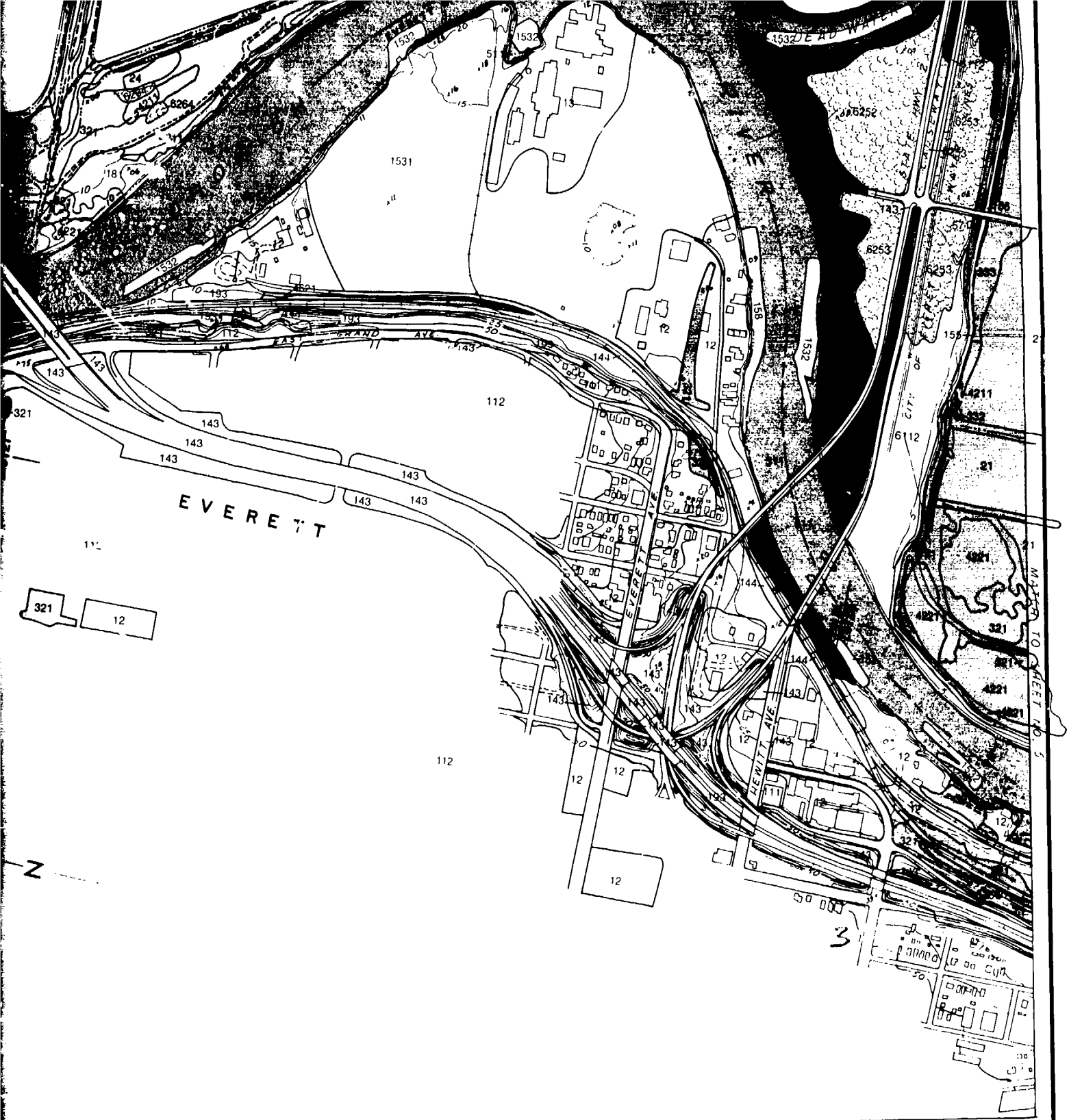


SNOHOMISH ESTUARY WETLAND STUDY — 1978

Classification and Mapping

400 0



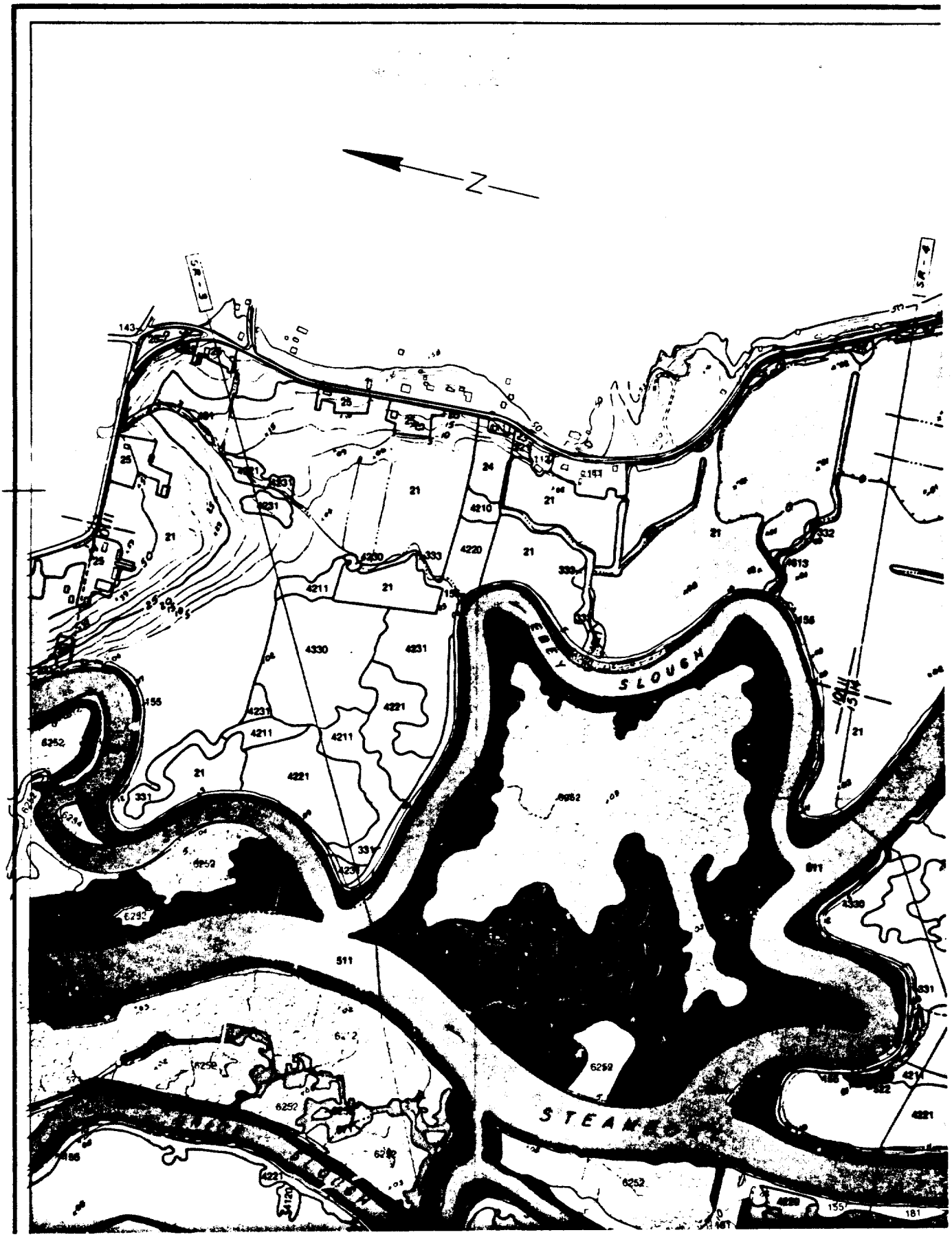
UARY WETLAND STUDY — 1978

sification and Mapping

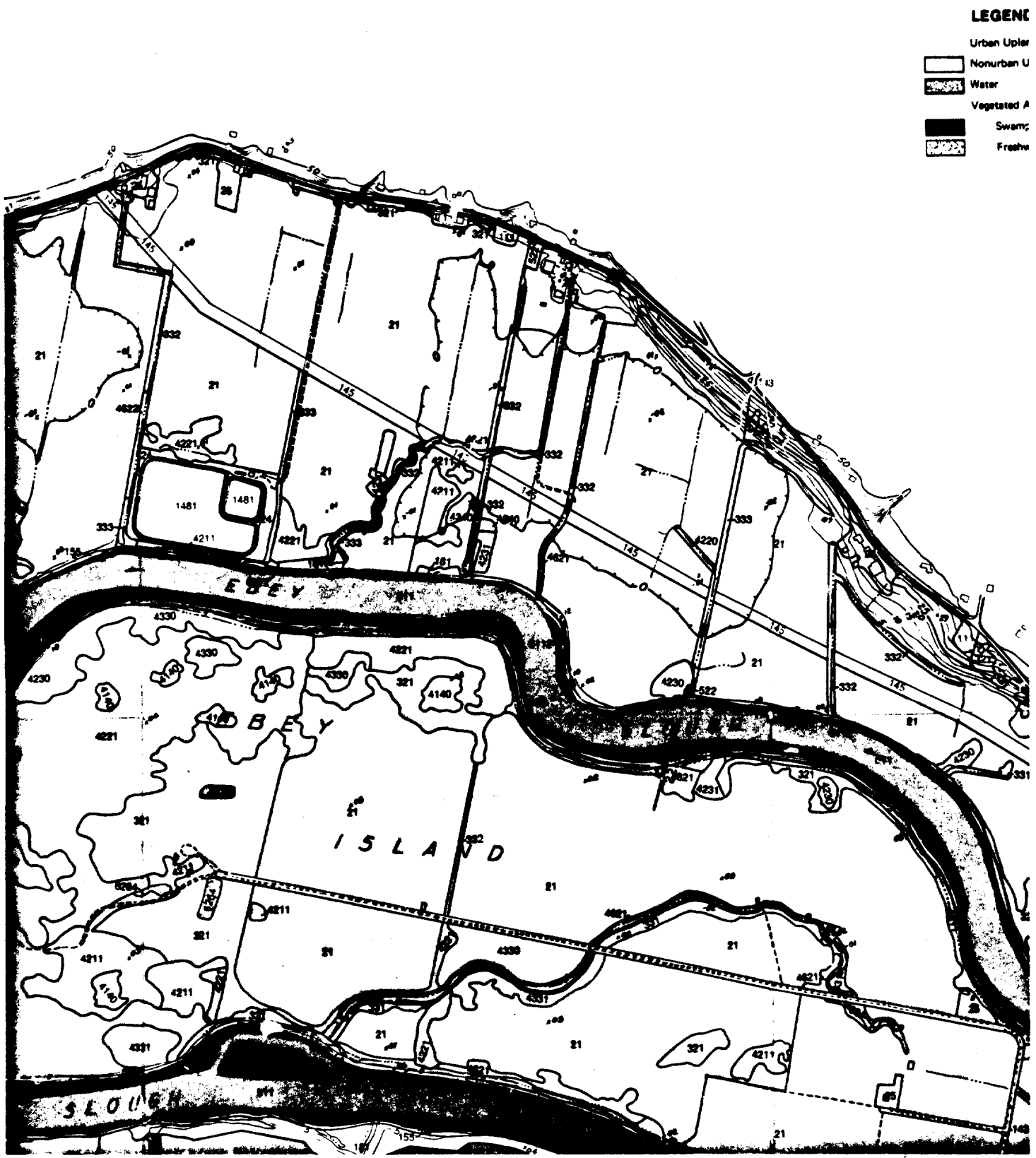
4

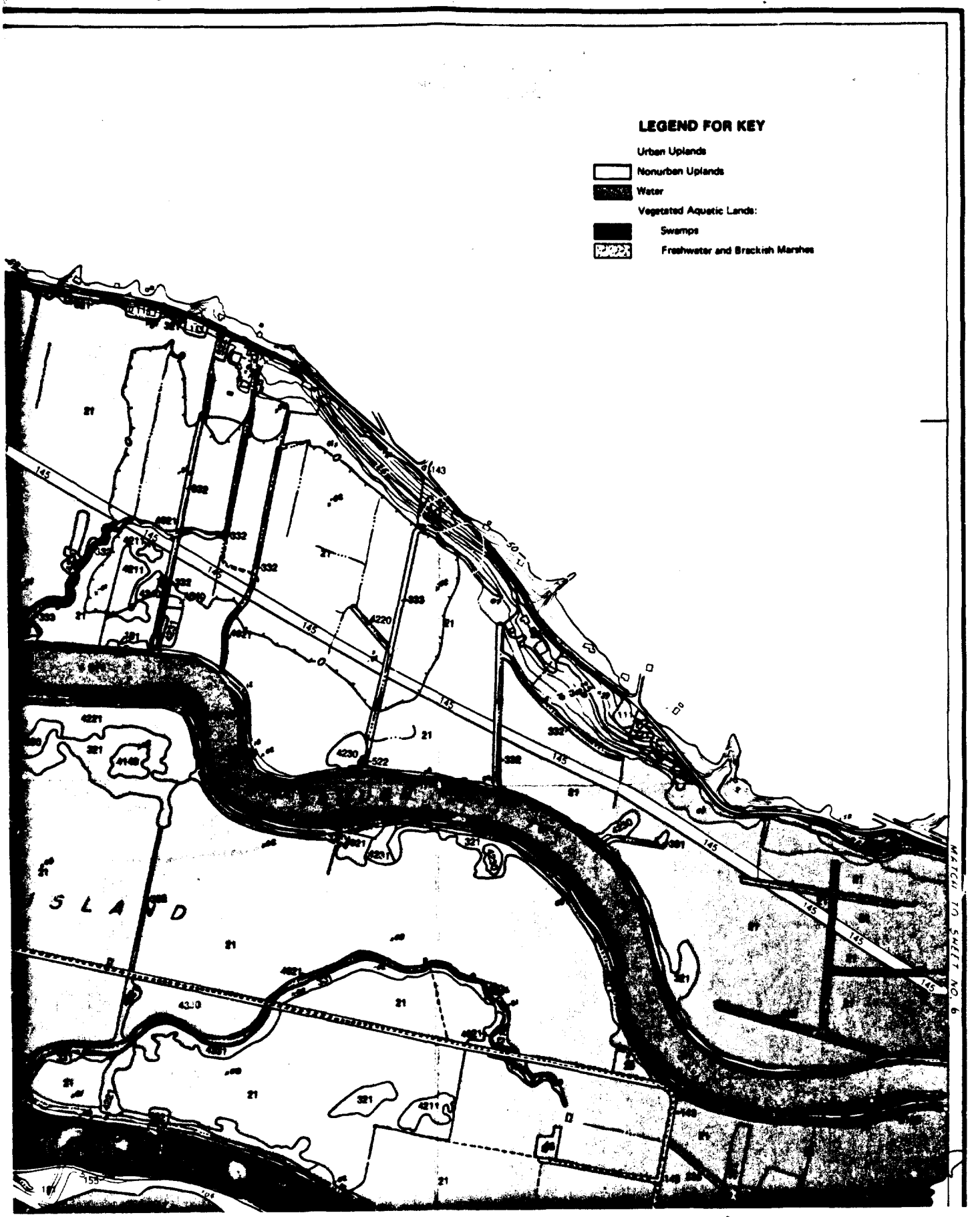
5

6


N
SR-9
SR-9
143
25
21
4210
4220
4211
4330
4231
4221
6252
6292
511
331
333
SLOUGH
STEAMBOAT
181

2


LEGEND
Urban Upla
Nonurban U
Water
Vegetated A
Swamp
Freshw
BAY
ISLAND
SLOUGH


LEGEND FOR KEY
Urban Uplands
Nonurban Uplands
Water
Vegetated Aquatic Lands:
Swamps
Freshwater and Brackish Marshes
SLAND
MATCH TO SHEET NO. 6

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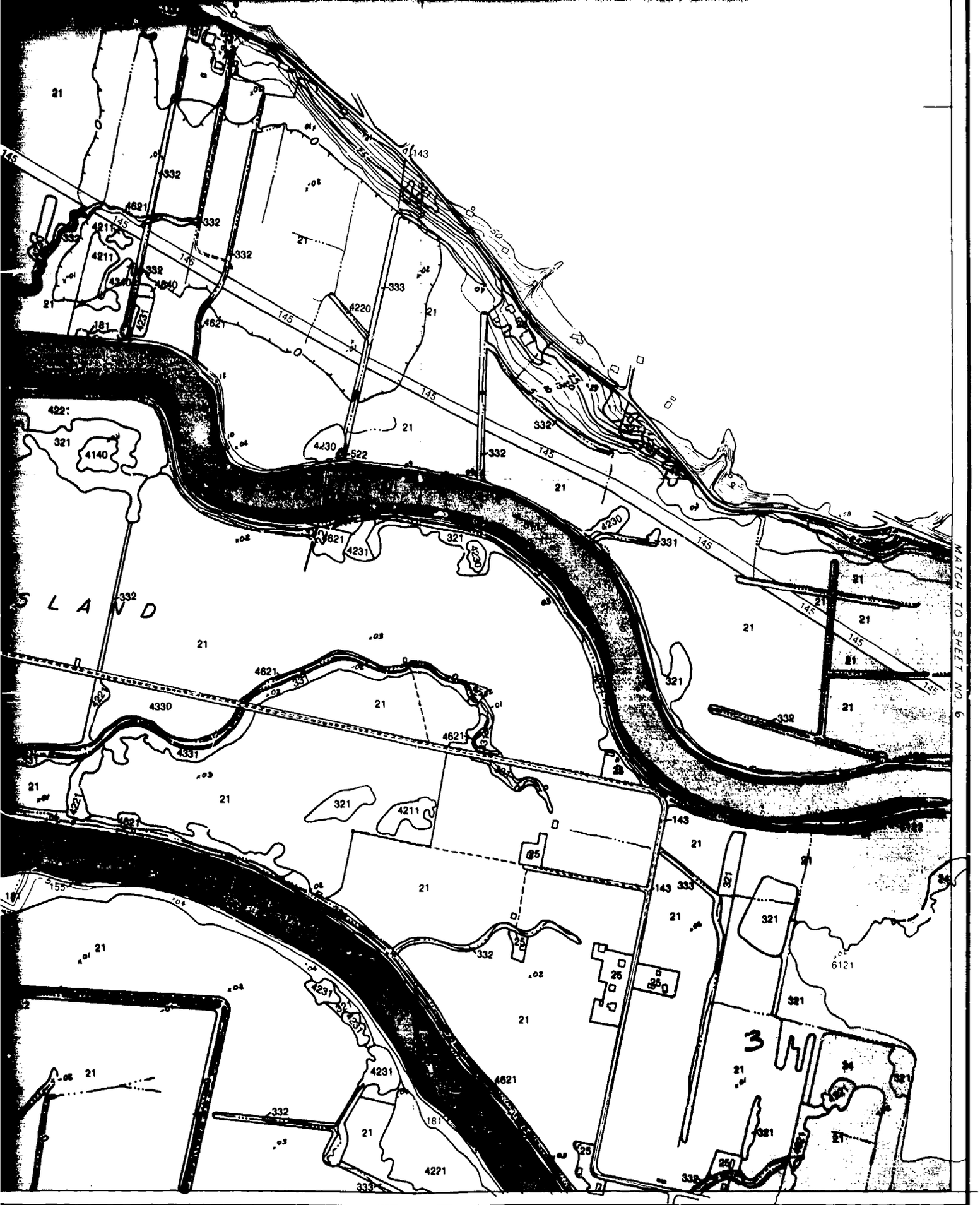
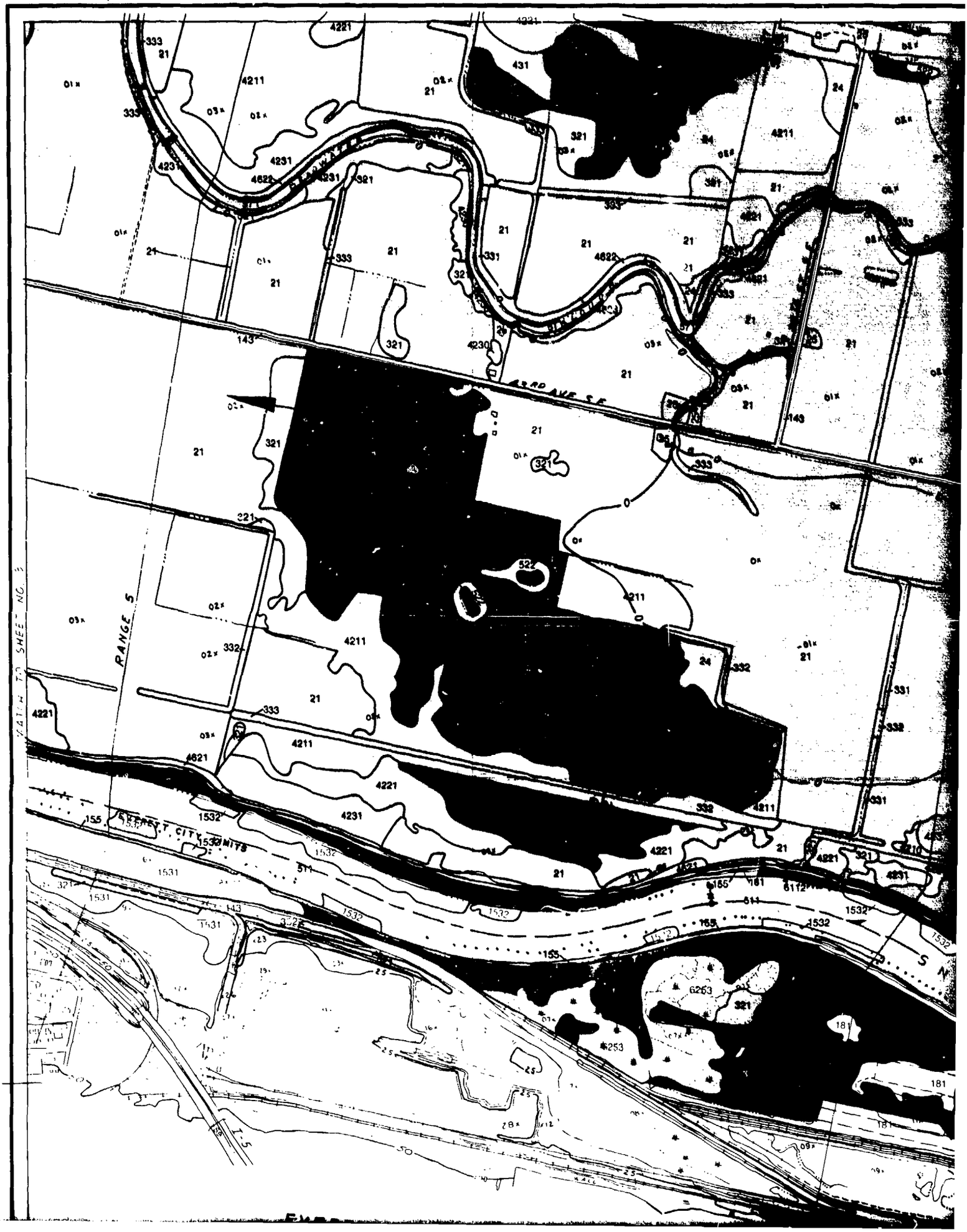
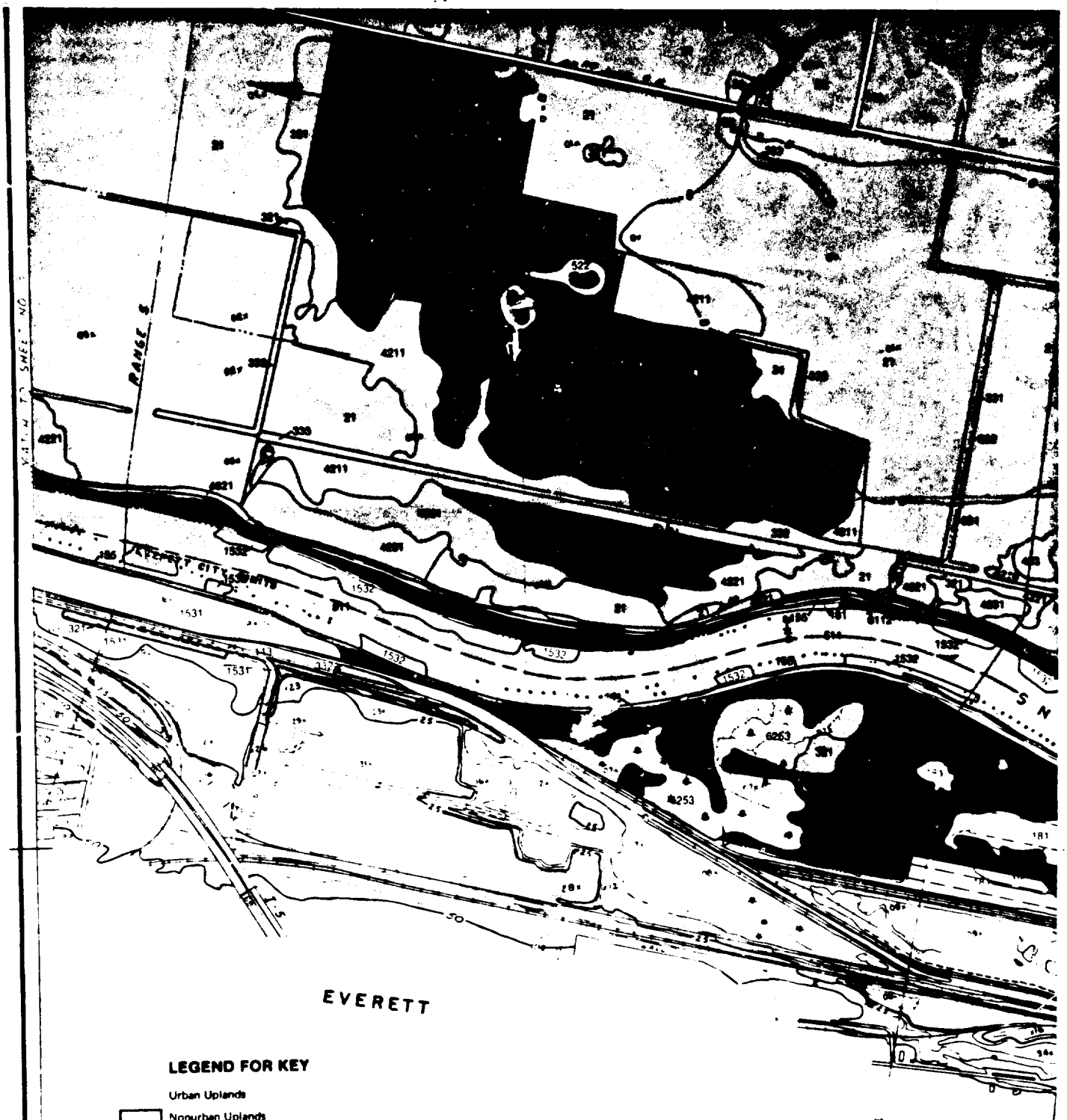


UARY WETLAND STUDY — 1978
ssification and Mapping

5


PATH TO SHEET NO. 5
RANGE 5
43RD AVE S.E.
EVERETT CITY LIMITS
I-5

2



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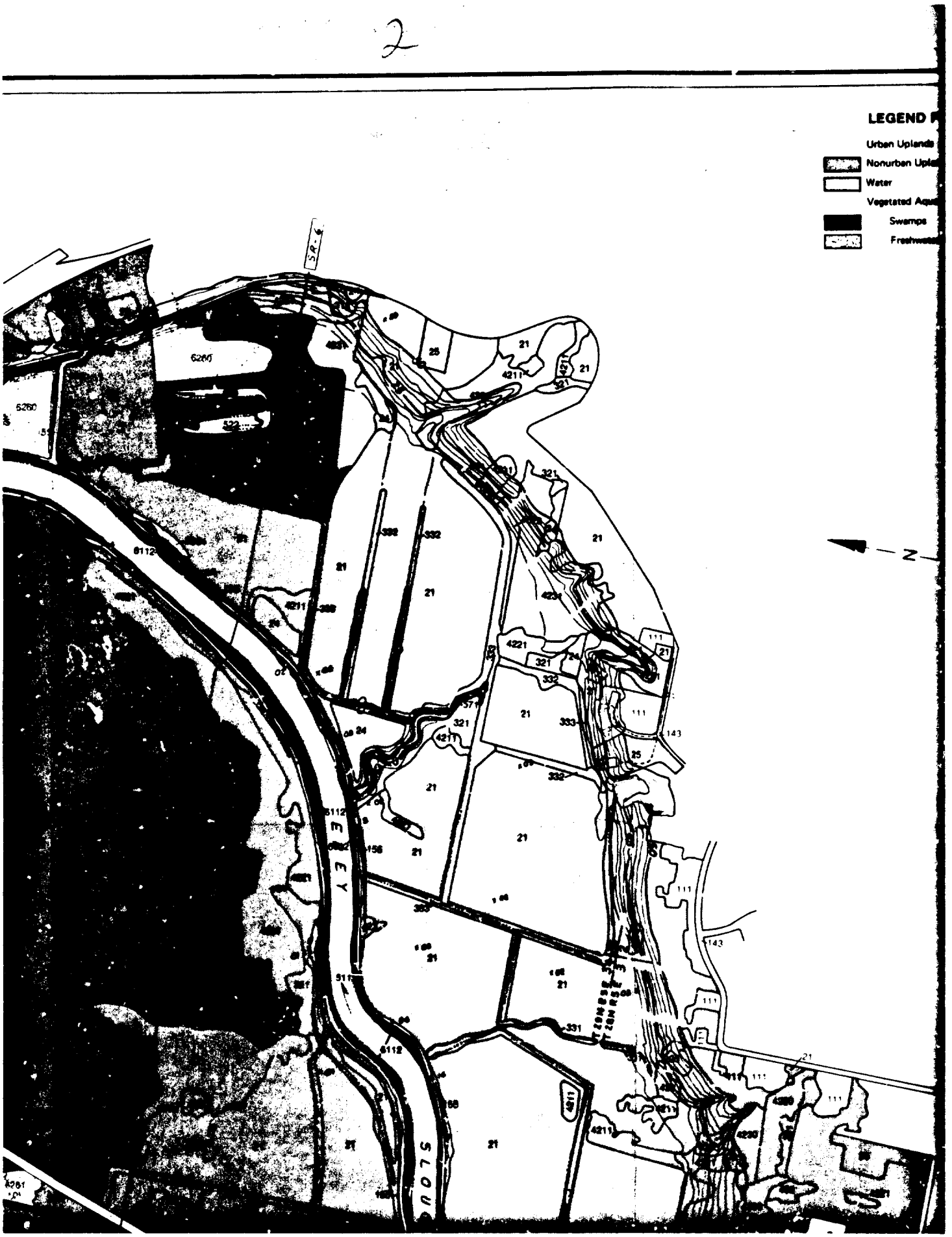
Classification and Mapping

ARY WETLAND STUDY — 1978
cation and Mapping

400 0 400 800 1200 FEET
WORK MAP FOR:

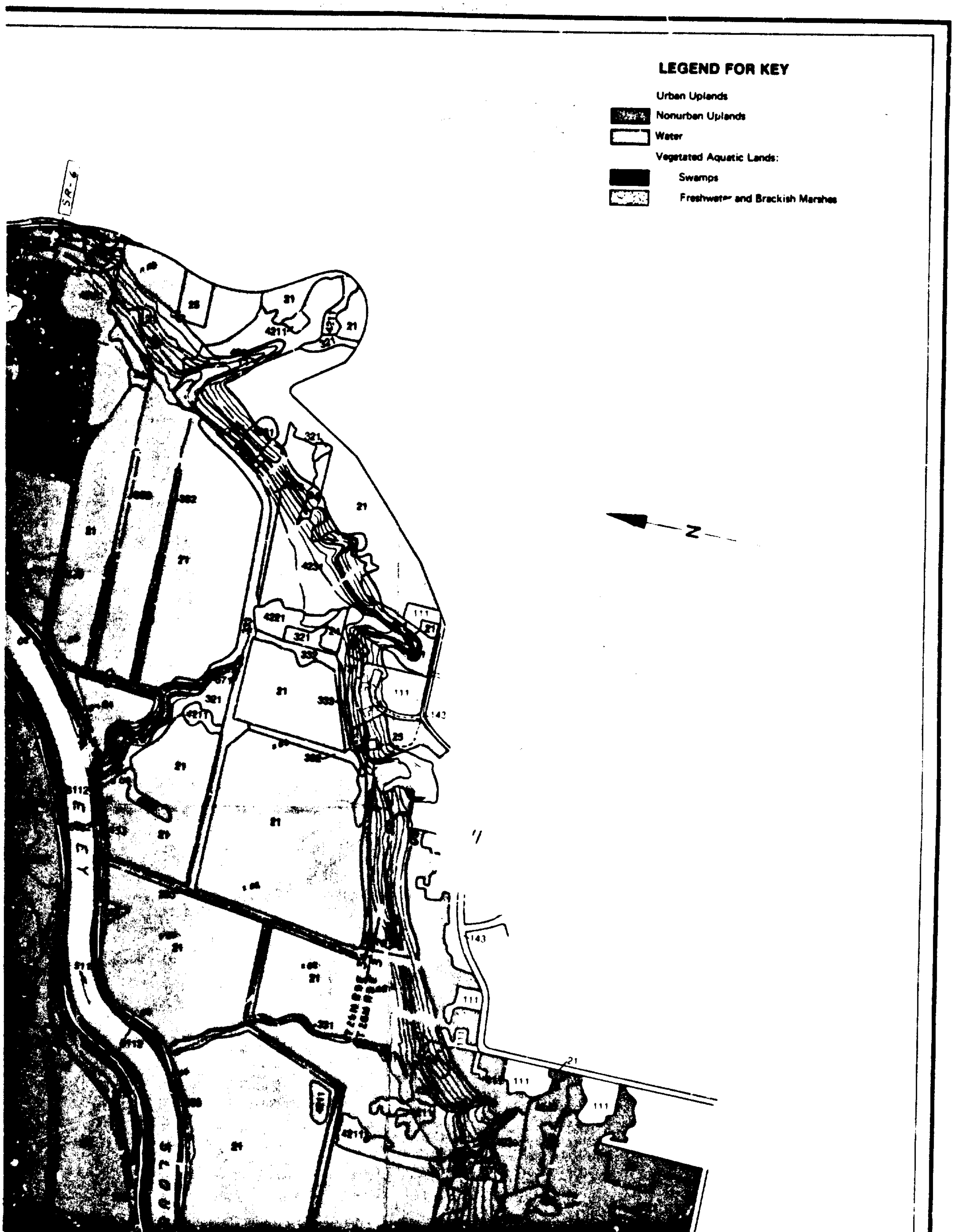
6


SLOUGH
EBEY
MATCH TO SHEET 10
TDM CANAL
U.S.G.S. RM 1
HWY. 2
143
145
21
332
4211
4221
511
321


LEGEND
Urban Uplands
Nonurban Upla
Water
Vegetated Aqua
Swamps
Freshwate
SR-6
SLOUGH
6260
6112
4211
4221
321
332
333
331
111
143
21
25

2

3


LEGEND FOR KEY
Urban Uplands
Nonurban Uplands
Water
Vegetated Aquatic Lands:
Swamps
Freshwater and Brackish Marshes
N
SR-6
21
25
4211
321
4221
111
143
331

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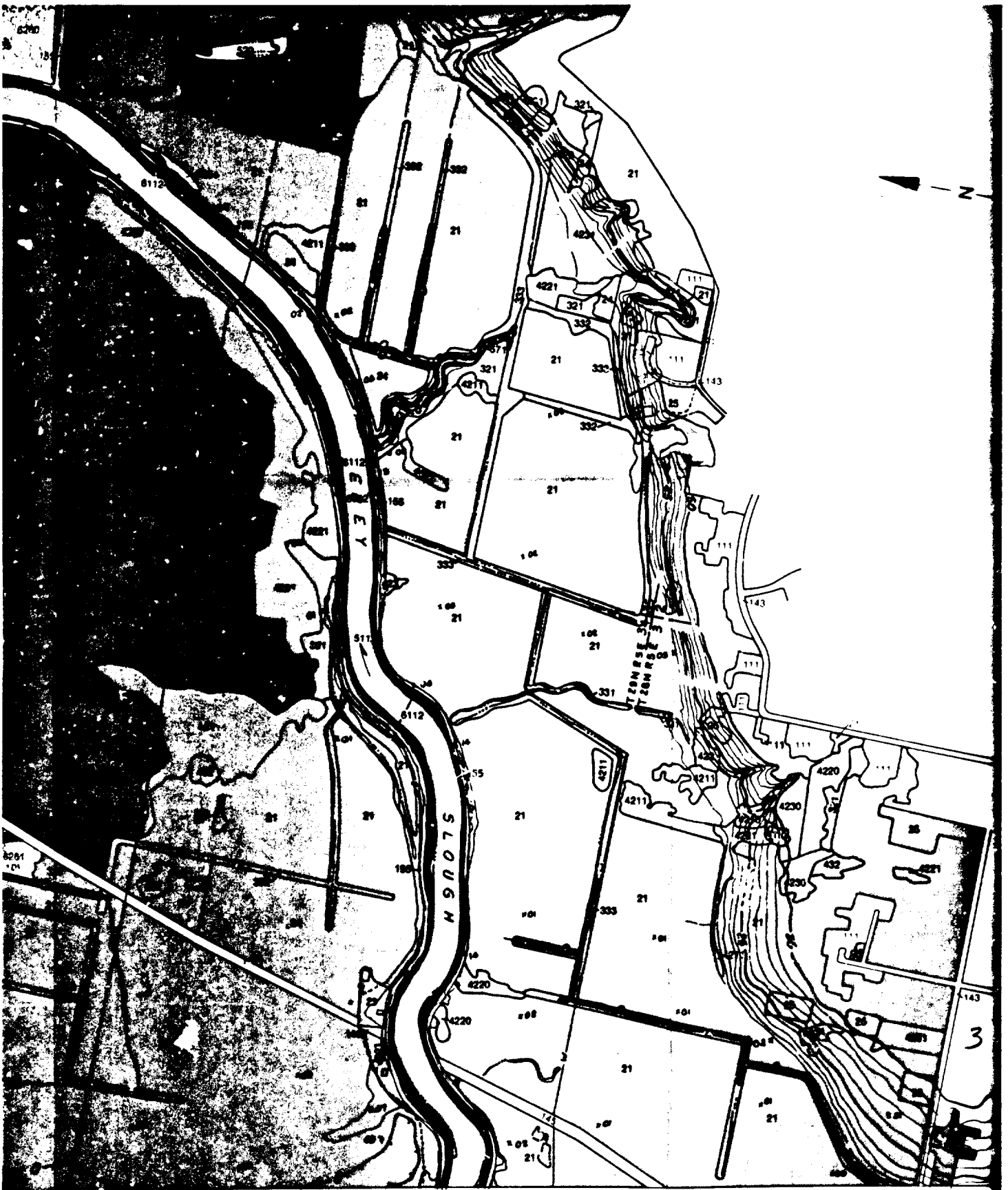

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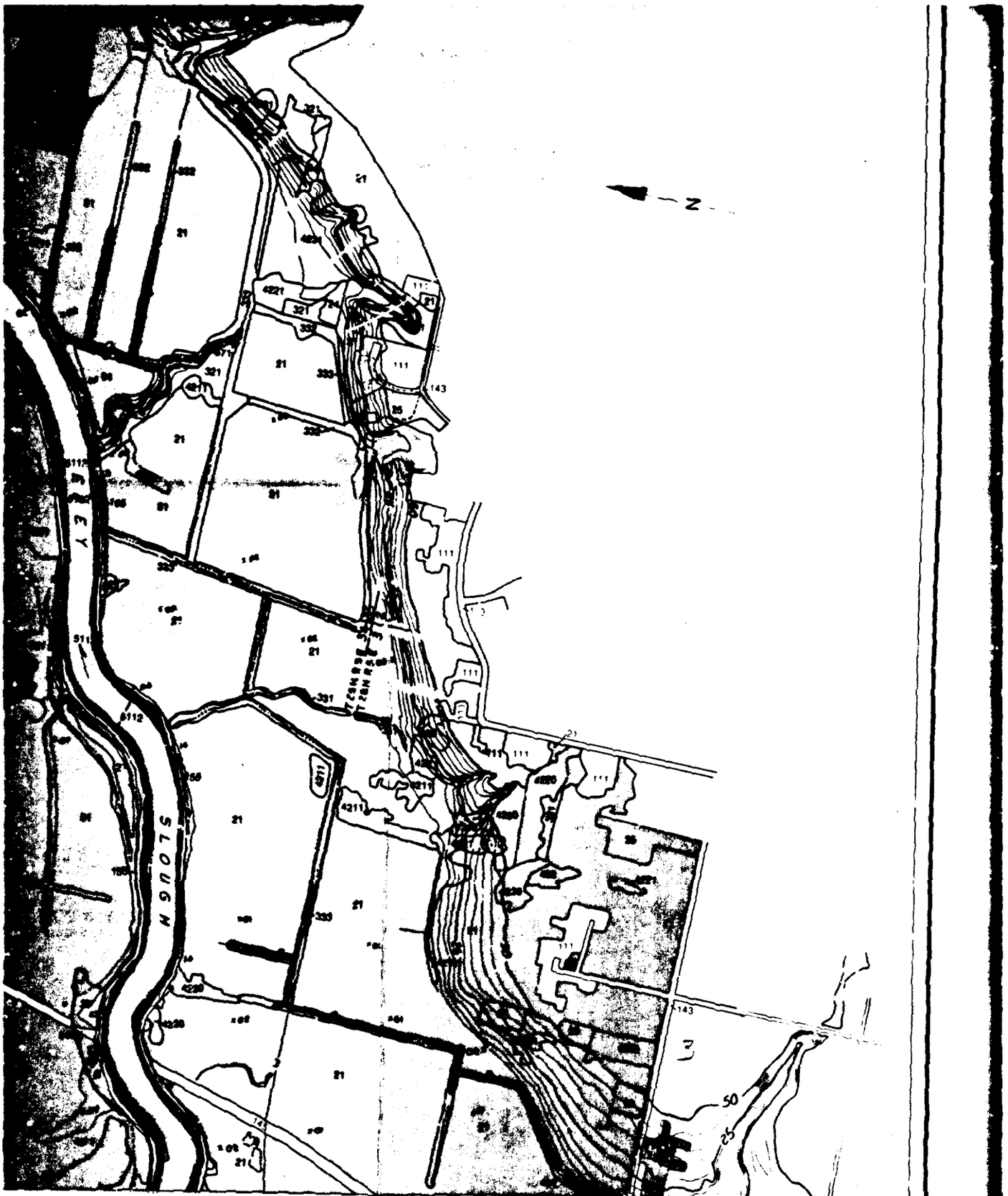
Classification and Mapping



.RY WETLAND STUDY — 1978
cation and Mapping